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The Proposed Increase of Dues in the American Society of Mechanical Engineers—A Last Word.

As this is our last issue which will appear before the forthcoming meeting of the American Society of Mechanical Engineers, what we say here upon the proposition to increase the cost of membership must be our last word before the vote is taken. Our original editorial on this general subject, "A Union Engineering Society House," published at page 935, was devoted chiefly to the advocacy of a house or headquarters to be occupied in common by all the leading engineering societies, and the second editorial, published at page 1126, was chiefly a protest against the lodging of the decision with the members who attend the meeting. Considered on its merits as a financial measure, we were not then convinced that the proposed increase was unwise. Developments since then have, however, shown clearly that the increase if made will, by reason of the resignations which will surely follow it, produce a much smaller increase of revenue than would be indicated by the simple ratio of the increase in dues. More than this, the flood of letters which has come to this office convinces us that our discovery of the legality of proxy voting has averted a great danger from the society. It is natural that we should hear more of the sentiment that agrees than of that which disagrees with us, but if our correspondence gives any indication at all, it is that the result of a vote which would have resulted in "taxation without representation" would have been to incur a risk of nothing less than a disruption of the society.

Our contemporary, "Engineering News," in its issue for November 21, gives the most thorough analysis of the situation that has been made, and we wish that it could be read by every member. After pointing out that during the past ten years the society has paid off $32,000 of its mortgage indebtedness, the pertinent question is asked: "What is the reason why the society, which got along comfortably ten years ago on an income of $18,000 now confesses itself financially cramped with an income of $42,000?"

Our contemporary now takes direct issue with the council in the matter of the dues of other societies. The circular of the council stated the dues of the Institution of Civil Engineers of Great Britain to be 4 guineas [$20.50] a year, while "Engineering News" declares that they are that for members resident in London only, for whom they are justified by monthly meetings, the charge to members residing out of London being but 3 guineas. Moreover, this extra charge for resident members is substantially paralleled in procedure, while it is exceeded in amount by the subscription of the New York members of our own society to the entertainment fund—for which fund the amount asked for this year is ten dollars per member. Moreover, full membership in the English society is only possible on the part of engineers who have "acquired a considerable degree of eminence"; other engineers being given associate membership only. In point of fact, there are twice as many associates as full members, and of the whole society but two-sevenths are full members and pay the tax of 4 guineas if resident in London, or 3 guineas if resident elsewhere. The other five-sevenths pay the equivalent of $12.80 if Associates and $7.68 if "Students" or "Juniors," with an addition of $2.56 for all three classes if resident in London, the average being materially lower than the present dues in our own society. We do not regard these figures from the English society as of any particular importance in this connection. The experiences of the American societies of Civil and Mining Engineers, which the council has ignored, are much more to the point, but our contemporary is justified in giving the space it does to this aspect of the case, by the fact that the recent circular of the council sought to justify the proposed increased by appealing to the "experience and wisdom of the English society."

The latest circular of the council states that "the question of the increase in the dues is practically independent, for the present at any rate, of any question affecting the headquarters of the society and the accommodation of its library." The chief program of advancement which is now urged is "the conduct of research and investigation," and it is for this, for the development of the library and the increase of the number and value of the publications, in addition to the wiping out of the existing small annual deficit, that the increase is urged. In the words of the circular, "the vote is really on this question." We have had, and have expressed, some sympathy with this idea of researches by the society, though not at an increased cost to its members, but we do not believe, with the issue narrowed down as it now is, that the members will regard the proposition with favor.

It is not to be forgotten that in any one year fully two-thirds of the members receive no other tangible return for their dues than the volume of "Transactions." This two-thirds varies in its membership from year to year, but that does not change the fact, which reduces the question as it must appear to most of the members to this proposition: Is the volume of "Transactions" worth twenty-five dollars?

As intimated above, our editorials have been followed by a voluminous correspondence. We cannot find space for any of these letters in full, but it is proper to give such extracts as will indicate the tenor of the whole. These extracts are given here, as they would be in our regular correspondence columns, as the views of the writers. The fact that they are in this column is not to be taken as an indication that we necessarily approve the views expressed. In fact we are opposed to some of them, but print them because their writers are entitled to be heard. In the nature of the case, many of the letters simply express approval of our course or disapproval of the proposed increase. It would serve no purpose to reiterate these, nor would it to repeat the expressions of indignation at the disfranchising of absentee members, which seemed at first to be inevitable, as that difficulty has now been happily solved. The names of the signers of the letters, if given, would be quite as impressive as their sentiments.

Leading men, college professors, chief engineers and managers of the foremost manufacturing enterprises are all represented in these letters. A decided feeling in favor of heavier dues from resident than from non-resident members will be noticed. With that principle we cordially agree, but non-resident members do not seem to know that it is already practically in force, although informally. The resident members subscribe each year to an entertainment fund, the amount asked from each one in former years having been five dollars, while this year it is ten. Of course this subscription is not obligatory, but few avoid it, we fancy. Against it, however, is the fact that one meeting of each year is held in New York, which the New York members attend without cost. We quote from letters we have received as follows:

"It certainly is a fact that the bulk of the membership get nothing but their volume of proceedings as a return for their dues."

"The members who live at a distance can never reap any benefit from the house or library. The proposed increase would practically shut me out of the society, as I could not stand it, and I expect there are others who will be unable or unwilling to maintain their connection if the increase passes. Really, all we receive are the papers. I would be very sorry to be deprived of the privilege I now enjoy, and trust that the measure may not go through."

"While there are many to whom $25 is a trifle, taken with other expenses of a similar character it is too much for the man of average income. Many members live far from New York and get no value from much of the present expenditure. Duplication of catalogs, large and small, every six months is for 90 per cent. of the members sheer waste. To expend funds on committees of research does not seem a proper business for the society."

"The present dues are quite a burden to many members. The more prosperous members should consider these members."

"It will of course be hard for me, as it will for many, and I believe it will not only lessen the number of new applicants but reduce the old membership. I only pay $7.50 for the German society fee, and the books are beautiful specimens. The last volume was 4½ inches thick and 12x10 inches in size of page."

"The Civil Engineers seem to get along with $15 annual dues for non-resident members, and to some of us it seems as if the Mechanical Engineers ought to be able to keep things moving without any greater charge. . . . Many may question whether it is worth while to keep up their membership if the additional charge is to be paid."

"I have been a member of the society from the second year and am one to whom the increased fee would come hard at this time, and I believe this is so with many."

"The arguments against the proposed increase are to my mind convincing, and it would be very unfair to the out-of-town members to impose this burden upon them."

"It is certainly not just to the outside scattered membership for the New York members to put the society to any unusual expense which would benefit only the New York or near-by members."

"I am opposed to increasing the annual dues of all the members until the experiment has been tried of increasing the dues of those members who for the past six months have resided in the vicinity of New York—say, within fifty-mile radius."

"I do not think it would make any difference as to my being a member personally if the dues were $50, instead of $25, per year, but I am bound to say, from the point of view of the outsider, that it looks very much as if the entire membership were being taxed to maintain a club-house and library for the members in and around New York. I get fully as much from the Mining Engineers for $11 per year as from the Mechanicals for the present dues, or would for the prospective ones."

"While, personally, I may be able to stand the additional $10 per year, I am unwilling to do so or to vote in favor of the proposition, because I do not see that the majority of the members of the society will get any benefit therefrom."

"There seems to be no objection to an increase in dues for those members in or near New York who have all the benefits and privileges of the society house, but for non-residents to be obliged to pay this increase without an adequate increase of benefits should not be entertained for a moment. The papers and 'Transactions' are now considered by many as hardly a fair return for the money expended. . . . Twenty-five dollars per year for one volume of 'Transactions' is an exorbitant price compared with other current technical publications."

"The advance reading of the papers is a worthless fiction instead of a valuable fact [because of the lateness of their distribution—Ed.], and therefore the advance copies are an unwarranted expense so long as the distribution is as at present. The binding of the 'Transactions' might well be a special charge to those so desiring their copies, as I should want mine. Many members are so situated as to make it an impossibility to attend meetings or even get to New York, except at rare intervals, so that the advantages of the library are of no account to them. There are, however, probably good reasons why the library should be free. The expenses of the social functions should be borne by those participating, and not be a charge upon the society at large. [The fact that the library is free enables the society to escape taxation on its house, we believe. The expenses of the social functions at the New York meetings are borne by the New York members, and similar functions at other meetings are paid for by the local members at the place of meeting.—Ed.]

"'I believe the increase in dues will decrease the receipts rather than increase them. It will keep out just the men who ought to be in. I also believe that less stationery and promiscuous printing will be a help to the society."

"I have been to the society's house perhaps three times in addition to the conventions, and have found only one member there, but there is a large office force and many helpers, and now another assistant has been appointed. I do not think it necessary to have so much work done to keep the society together, and am very much against raising the dues. My idea would be to simply hire a hall for a few days a year, which need not be on Fifth avenue either, and to discharge some of the help we now have."

"I am in favor of reducing the expenses of our office and the binding of the 'Transactions' must be omitted. We only want one secretary instead of three."

"I am in favor of some changes in the way the society is conducted."

"The council must have known the financial condition of the society for some time. Why, then, did they so recently appoint another assistant to the secretary? The clerical force now numbers four, I believe, while the secretary spends but little time at the society house. It seems to me that half this force should do the work. The expenses seem to increase faster than the membership. Why is this thus?"

"I am one of the last to wish to cripple the society, but I do think the proposed dues are more than necessary and think it probable that half the increase would more than cover the matter."

"I have yet to hear of anyone who approves of the increase."

"We [one of the foremost machine shops of the land.—Ed.] are united in our opposition to the proposed change in dues."

"I have felt for some time that the society is rather heavily loaded, and my own preference would be for an engineering headquarters wherein all the affiliated organizations could be accommodated with a union library, etc., and assume the expenses pro rata. Personally, I do not feel that I can afford any increase of dues, and there are very many others upon whom it would be practically prohibitive to continuance of membership."

"It does seem to me that this society, which numbers among its membership men whose chief business is to curtail expense and increase the efficiency of machines, methods and men, should apply these principles to the management of the society before adopting so large an increase in the dues."

"While an increase to $20 might be possible, I think that an increase to $25 would simply cut down the membership and so

lead to a loss rather than a gain, and I think a reduction of expenses decidedly preferable."

"It is known to all that most institutions, whether business, educational or professional, are more or less hampered in arriving at their ideals by the want of funds, and undoubtedly this society is no exception, but a call for over 70 per cent. increase [67 per cent.—Ed.] should carry with it the most definite explanation of the advantages to be gained."

"Would any engineer who had any respect for his own reputation advise any concern in financial embassassment to float a perpetual load at 7 1-10 per cent. annual interest? The Council propose to issue life memberships at $350 each and no dues. The dues at $25 amount to 7 1-10 per cent. of the investment. If engineers are as astute financially as they are supposed to be, they will send in their checks for $250, for we all know that in these times safe investments cannot be made at better than 4 per cent. I believe we are beginning at the wrong end of the problem—we should stick our knife into the expense account first."

The Reciprocity Convention.

The much talked of Reciprocity Convention has come and gone, and it is fair to say that those who hoped that it would prove an important help toward the solution of some of the most important questions that confront American manufacturers to-day have been disappointed. True, some vigorous speeches were made in favor of greater commercial liberty and some that showed the utter needlessness, if not the iniquity, of some of the present import taxes, notably that on hides; the only effect of which was declared to be to still further enrich large packing corporations by millions taken from the pockets of American users of leather goods, and to hamper and restrict our foreign trade in those goods. But though a number of delegates expressed these views, when it came to action by the convention nothing was put on record that can be said to enable a Congressman or anyone else to quote the assembled manufacturers as favoring or recommending anything except to let things drift as they are doing.

Of course it is clear that the present generally good condition of business had much to do with this. Had it been true at this time, as it was true a few years ago, and may easily become true again, that American machine shops were to be found sending 75 per cent. of their output into foreign markets, the necessity of doing something to cultivate foreign trade or of doing something to lessen the restricting influence of our fiscal policy would have been much more clearly seen.

As tending to show how easily a convention of this kind may be swayed by arguments smoothly presented, but which have absolutely no merit in them, the talk of C. H. Clark about a reciprocity treaty that we had with Canada, and which was terminated in 1866, may be cited. Mr. Clark readily showed by figures that that treaty had not resulted in an increase of exports of manufactured goods from this country, and there seemed to be few manufacturers present who were ready to make the obvious reply that the conditions prevailing in our industries at that time were so entirely different from the conditions of to-day that deductions drawn from that experience must necessarily be practically worthless.

The Reciprocity Convention was called primarily because a great many manufacturers had come to perceive that the vastly changed conditions that have come about in our industrial conditions within the past ten years, especially with respect to foreign trade, seem to make it absolutely necessary to take these altered conditions into account. In other words, the convention was composed largely of manufacturers who had clearly perceived the altered conditions, had as clearly perceived the importance of taking some action to meet them, and had met to confer as to the best possible action. Yet a glib talker seemed to carry the convention with him in the opposite direction simply by the presentation of an argument that will not stand a moment's examination.

There may be those who think that this closes the career of reciprocity, and probably it does seal the fate of the Kasson treaties, but the subject, in some form, is bound to be revived and to become more and more pressing, until finally and definitely settled; because it remains true, as President McKinley said at Buffalo: "We must not repose in fancied security that we can forever sell everything and buy little or nothing. If such a thing were possible it would not be best for us or for those with whom we deal. . . . The period of exclusiveness is past. The expansion of our trade and commerce is the pressing problem. Commercial wars are unprofitable."

Mr. A. Falkenau, of Philadelphia, sends us a proposition sent him by the Osborne Oil Company, of Cleveland, Ohio, which company offers to send him "1½ barrels of Extra No. 1 Lard Oil, which were left over from a car load." This oil is, as usual, "warranted to be the best in the market and subject to examination," but it is offered at "a special, reduced price." The Osborne Oil Company is a new name to us, but we note that it is equally unfortunate in regard to its shipments of oil and is compelled, as so many other Cleveland, Ohio, dealers in oil are, to offer some shipments at reduced rates for various reasons. Mr. Falkenau of course recognized the character of the offer and instead of replying to it sends it to us. He says he finds no such firm mentioned in the commercial reference books.

Commercial Review.

NEW YORK, Monday, Nov. 25.

MACHINERY AND SUPPLIES.

The depression in Germany which has been accompanied by an easily supportable loss to American tool builders has been a more serious matter to the German importing trade, and it is inevitable that in some instances this truth will be emphasized in a harsh and unfortunate manner. News has just come that Gustav Diechmann & Sohn, of Berlin, have asked their creditors for a compromise settlement. Full particulars have not been received. This firm, as is known, are agents for some of the foremost American manufacturers, including the Brown & Sharpe Manufacturing Company, and their relations on this side of the water have been cordial. The news will be sincerely regretted by their American friends, and it is to be hoped that satisfactory arrangements will be made by which the firm will continue business.

Two Westinghouse-Parsons steam turbines of 1,000-kilowatt capacity each have been ordered for the De Beers Consolidated Diamond Mines, Kimberley, South Africa. They will be built by the Westinghouse Machine Company and direct connected generators for same will be constructed by the Westinghouse Electric & Manufacturing Company. The contracts placed in this connection, including, it is understood, some further apparatus, amount to $135,000. This order for steam turbines is the first—at least of such a size—which the Westinghouse people have received for export.

Negotiations are being made for the formation of a single company to consolidate a number of domestic and foreign companies engaged in the pneumatic tool and air compressor line—a group of concerns, however, almost or quite all of which are already affiliated. They include the Chicago Pneumatic Tool Company, Boyer Machine Company, of Detroit, Mich.; Franklin Air Compressor Company, Franklin, Pa.; the Tate-Howard Company, of Manchester, England, and perhaps one or two others. The matter has not so far progressed that a formal announcement can be made. It is learned, however, that one of the features of the project is the establishment of a plant in Germany.

The Chicago Pneumatic Tool Company is still enjoying an intensely active trade. The European demand is generally good, although in Germany it is rather quiet. Russia is buying well. Japan is an excellent customer. Two 500-foot air compressors of the Franklin Air Compressor Company have recently been ordered for Japan. They are intended for driving pneumatic tools in connection, it is believed, with government railways.

A certain electrical manufacturing company which has its head office in this city and which is in close touch with the local demand for the small motors—the C. &

C. Electric Company, to be specific—states that never before has there been such a demand in town for its small motors to go on the Edison circuit for manufacturing purposes as there has been in the last sixty days. In that time it has sold something like 100 motors under 25 horse-power for use on Manhattan Island. This report is one of the best evidences of national prosperity, because it relates to the substrata of industry and is more significant than many sales of supplies which might be in requisition by the larger concerns.

The earnings of the General Electric Company for October are said to have amounted to $1,000,000, breaking all previous records, and from orders now on hand it is expected that the company will show $1,000,000 per month the balance of the year. The amount of earnings is not to be confused with that of "orders booked," which is of course much larger.

The American Turret Lathe Manufacturing Company is the name of the concern organized on the basis of the American Turret Lathe Company of Wilmington, Del., incident to the expansion of the business. The new company has a capital of $250,000 and the following officers: President, C. M. Conradson; vice-president, Charles Jacobson; treasurer, John Smith; secretary, W. L. Miller. The plans for the plant which the company is about to build at Warren, Pa., were published last week.

Twist-drill manufacturers report a trade ranging from very fair to very active. November seems to have shown, if anything, an increase in demand as compared with October.

The Wais-King Tool Company, which has recently been organized in Cincinnati and will build a plant there, has been purchasing machine-tool equipment. Some of it has been ordered in the New York market.

Early in the present year—on pages 258, 280 and 350—we published some accounts of a new method for brazing cast iron, called the "Ferrofix" and "Borfix" process which was attracting considerable attention abroad. At the time it was too soon to tell whether the remarkable qualities attributed to it could be realized in practice in this country. Since then it has been systematically taken up by a concern called the "America Ferrofix Company," whose office is at 20 Broad street, New York. The results so far attained seem to indicate that the process is proving a success.

The S. Obermayer Company, main office Cincinnati, Ohio, dealer in foundry facings, supplies and equipments, has opened a Pittsburgh office and warehouse at Thirty-fifth and Charlotte streets. A full line of foundry supplies will be carried in stock.

In the recent annual report of Rear Admiral Kenny, Paymaster General of the Navy and Chief of the Bureau of Supplies and Accounts, he discusses some questions of general interest to contractors for supplies. One of these is the system of exacting penalties for non-fulfillment of contracts within the time specified, which has been in force for two years. This system has worked very satisfactorily. While the Department interprets this regulation liberally for the bidders, it does not consider wise to remit penalties beyond the latitude of grace allowed therein. In effect, it holds with the Comptroller of the Treasury that time is a vital element in the contract and that a policy of granting extensions would be an actual fraud upon the unsuccessful bidders. A recommendation is made to amend in bidders' favor the present law as to security for the execution of contracts, the terms of which are so onerous as frequently to deter dealers from bidding. At present if a certified check is filed as security, it has to be for the full amount of the proposal. The recommendation is to leave the proportion of that amount to be fixed by the Department. If a bond is filed as protection, it is suggested that this might be arranged to be done annually to cover all undertakings that the contractor may enter into with the Bureau, thus saving the inconvenience of procuring a bond in each case.

CHICAGO MACHINERY MARKET.

The largest buyer of machine tools in the West during the past month was the Union Pacific Railroad Company for the equipment of the shops at Omaha and perhaps at Pocatello, Idaho. The heavier iron-working tools and the wood-working machinery are said to have been purchased, the whole amounting to a pretty figure, but there remains unclosed quite a batch of specifications for medium and small-sized tools. Other railroads have been buying also. The Burlington has been a good buyer and the Lake Shore continues to order steadily for its coming shops at Collinwood, Ohio. Some of the tools bought for that edifice have proved such treasures that the company is not waiting for its completion but has installed the machines in the old shops, where they are giving a good account of themselves. The Michigan Central has no list of specifications out yet, but one is expected soon. The railways, in fact, are among the best customers in the Western trade. There is good prospect that their buying has not come to an end. One prominent machine-tool representative remarks that many of the roads do not fully appreciate the repair and manufacturing conditions that confront them and acordingly have not fitted themselves for the inevitable work to come. Everything points to a very heavy trade of that kind during the next year or two.

The machine-tool trade generally during November has been reasonably satisfactory. There has not been quite the volume of October, but, as the months of the year go, there is no cause for complaint. And with the activity there is celerity. This is illustrated by the purchase of an equipment by a Michigan concern recently burned out. Bids were asked, but before all of them were received, the business was secured by the hustlers first in the field. There was no time for delay. Orders were too pressing. And in a modified way the same conditions apply to the trade in general. There are few inquiries unless the machines are wanted promptly. Hence sales are easily negotiated. Prompt shipments are generally procurable from factory, but some of the Western factories are running double turn and others are farming out a portion of their work. For large machines there are of course delays in delivery. The prospects of the machine tool trade are heightened by the satisfactory condition of other lines, as the engine trade which is sold up not uncommonly from nine to twelve months. Users will not order machine tools so far in advance as that. Four or five months are about the outside limit. A shop can be built within that time.

Among recent orders of the Railway Supply Company were a large steel cutting saw—the fourth—for the Woolwich arsenal, Woolwich, England, and a similar saw—the second—for the French Government dock yards at Cherbourg, France.

Stephens & Tyler, Chicago, have contracted to double the power of the Fulton Electric Lighting & Power Company, Fulton, Ky., the equipment including two 350 horse-power Corliss engines.

Quotations.

NEW YORK, Monday, Nov. 25.

Pennsylvania Foundry Pig Irons, Jersey

No. 1 X	$16 15 @ $17 50
No. 2 X	15 65 @ 16 15
No. 2 plain	15 15 @ 15 65
Gray forge	14 75 @ 15 00

Alabama Pig, New York delivery:

No. 1 foundry, or soft	15 75 @ 16 00
No. 2 foundry, or soft	15 25 @ 15 50
No. 3 foundry	14 75 @ 15 00
Foundry forge, or No. 4	14 25 @ 14 50

Bar Iron—Base sizes—Refined brands, mill price on dock, 1.68c. in carload lots. From store, 1.90 @ 1.95c. in small lots.

Tool Steel—Base sizes—Good standard quality, 7c.; extra grades, 10c. and upward.

Machinery Steel — Base sizes — 1.90 @ 2.00c. from store.

Cold Rolled Steel Shafting—Base sizes—From store, 2¼ @ 2½c.

Copper—Lake Superior ingot, 16¾ @ 17c.; electrolytic, 16¼ @ 16⅝c.; casting, 15¾c. upward.

Pig Tin—In 5- and 10-ton lots f. o. b., New York, 29 @ 30c., spot.; 26¼ @ 27c., December.

Pig Lead—For wholesale lots, 4⅜c., with .02½ @ .05c. extra for carloads.

Spelter—4.30 @ 4.37½c., New York delivery.

Antimony—Cookson's, 10¼ @ 10⅜c.; Hallett's, 8¼ @ 8⅜c.; Italian, 7¾ @ 8c.

Lard Oil—Prime City, 74 @ 76c., in wholesale lots.

Notes on Crane Design.

BY A. D. WILLIAMS.

The modern electric crane has a motor for each motion, those generally used being series wound for 220 volts. Direct current is mostly used for crane service, but some have been built for use on alternating circuits. The series winding has advantages for crane purposes. It gives a high starting torque, at least double its running torque, and the speed varies with the load. These motors are usually rated by their horse-power at a certain speed, which is what they are capable of on continuous work. In crane service they can be more heavily loaded, as the work is not constant, so that they get a better chance to cool off. The best motors for cranes are those which are completely enclosed in a dust-proof casing, although unenclosed motors have given satisfactory service in very unfavorable surroundings. Large commutators are desirable, and the motors should run practically sparkless in either direction under different loads at varying speeds. Machines built on the interchangeable plan make easier repair work and incidentally save time at critical moments.

It is a good plan to have the typical curves of the motors to be used, as they come in handy if anything like close results are required, and the curve tells just what the motor can be expected to do at any load. Commercial sizes of motors are usually employed for cranes, and the crane generally figures out an odd size, which means, look at the curve.

In designing the trolley of an electric traveler, the space available is one of the first things to be determined. A high trolley will give a long hook travel, and if the hight is cut down, the trolley is lengthened and the hook travel reduced. The gearing has to be laid out to suit the space at hand, and while a new trolley may be interesting, the eraser will be found very useful.

In this work some calculating has to be done, and a slide rule will be found convenient. Some of the formulas given contain abbreviations that are well known, and others will be explained. Torque is a term that is not used as widely as it should be. It means twisting moment, and its brevity should recommend it, as the twisting moment in inch- or foot-pounds determines the pitch and face of gears, and when combined with the bending moment, the size of shafting, torque and speed determine the horse-power, and *vice versa*, thus:

$$\text{H.P.} = \frac{\text{Torque} \times \text{R. P. M.}}{63000}$$

$$\text{Torque} = \frac{63000 \text{ H.P.}}{\text{R. P. M.}}$$

In these formulas the torque is measured in inch-pounds. They are obtained by shortening up the following equation and combining its constants:

$$\text{H.P.} = \frac{\text{Pull on brake lever in pounds} \times \text{Lever arm in inches} \times \text{R. P. M.} \times 6.2832}{12 \times 33000}$$

The pull on the brake in pounds multiplied by the lever arm in inches gives the torque or twisting moment in inch-pounds The constants combine as follows:

$$\frac{6.2832}{12 \times 33000} = \frac{1}{63021}$$

and if this is taken as $\frac{1}{63000}$ it will be practically correct and more convenient. Dynamometers can be made to give readings in inch- or foot-pounds torque very easily, and save some calculating.

A rough assumption is that 1 horse-power will lift 1 ton 10 feet per minute. This is not strictly accurate, a higher efficiency being attained in practice.

A closer formula is:

$$\text{H.P.} = \frac{L\,V}{33000\,k}$$

in which

L = load to be lifted in pounds,
V = speed of hoist in feet per minute,
k = percentage of efficiency of hoisting mechanism, which varies, but generally runs over 70 per cent. It is lowest in a new crane, as the mechanism is stiff. Careless alinement will reduce the efficiency. Crane tests sometimes show a much higher efficiency than 70 per cent.
R = pitch radius of drum in inches,
n = number of parts of chain or rope,
Td = torque on drum,
Tm = torque of motor,
S = speed of motor (R. P. M.),
s = turns of drum per minute to give specified speed of hoist.

If the hoisting is to be on one end of the chain, the other end being anchored, then we have:

$$s = \frac{V\,n}{2\,\pi\,R}$$

If the hoisting is to be done on both parts of the chain, using either one or two drums, we have:

$$s = \frac{V\,n}{4\,\pi\,R}$$

In either case we have:

$$\text{Load per part on chain} = \frac{L}{n}.$$

The load per part determines the size of rope or chain to be used. The factor of safety should be high.

We also have:

$$Td = \frac{R\,L}{n}$$

for the torque on one drum of a double drum trolley, or the torque when hoisting on one end of the chain, the other end being anchored. If both ends of the chain are anchored to the same drum:

$$Td = 2\,\frac{R\,L}{n}$$

The torque on the drum is the basis from which the tooth load of the gearing is obtained by familiar methods. The pitch and face of the gears can be taken from some of the tables or diagrams which have been published in the "American Machinist." The diameter of the various gears will be settled by the space available to get the necessary reductions in.

We also have:

$$Tm = \frac{63000 \text{ H.P.}}{S}$$

If no motor curves are at hand an approximation to the gear ratio can be obtained from the equation:

$$\text{Gear ratio} = \frac{Td}{k\,Tm}$$

As the motor curves are not straight this method may not give exactly what is wanted.

Using the motor curves, the speed and torque at the calculated horse-power are found when using these values for Tm and S:

$$\frac{Td}{Tm} = \text{torque ratio (a)}$$

$$\frac{S}{s} = \text{speed ratio (b)}$$

These ratios give the limits between which the correct gear ratio lies and by a little cutting and trying the gear reduction will be found. In most cases three pairs of gears will give all the reduction necessary, and when very slow motors are used two pairs will be sufficient.

The calculations for the bridge motor are similar to those for the hoist. Let:

L = weight of crane plus load in pounds,
R = radius of track wheel in inches,
r = radius of track wheel axle in inches,
Tl = torque due to load,
Tm = motor torque,
M = traction,
K = gearing coefficient,
k = journal coefficient,
V = speed of crane in feet per minute,
S = speed of motor (R. P. M.),
n = turns of track wheel per minute to get specified speed.

k can be taken as approximately 10 per cent. and K at 85 per cent., and we have:

$$\text{H.P.} = \frac{M\,V}{33000}$$

$$M = \frac{L\,r\,k}{R\,K}$$

$$n = \frac{V}{2\,\pi\,R}$$

$$Tl = M\,R.$$

Referring to the motor curve, the speed and torque of the motor at the calculated horse-power are found and from this on the same method is used as for the hoist train. The trolley travel train can be figured by the same forms used for the bridge travel.

Naturally experience gained in designing cranes is a much better guide than any other. All calculations should be kept in such a manner that they are accessible for reference, and the result of the crane tests should be compared with the calculated results. If this is done, an accurate

knowledge will be gained regarding the results to be expected.

The standard design for a trolley once settled, changes are not desirable from the manufacturers' standpoint. This implies sticking to the same motor, as motors are rarely interchangeable either in space occupied or speeds.

Crane bridges cannot be made on the same plan as trolleys, as spans and head room differ widely, but if systematic methods are used a great deal can be done in the way of reducing the office work on girders and bridge mechanism.

The Card Index System in the Purchasing Department.

BY F. H. LELAND.

There appeared in these columns, some time ago, a most admirable article on the purchasing agent. The writer of that article clearly set forth the many reasons why the purchasing agent should be all that the name implies, and not a mere buyer—a bargain hunter.

It occurs to the writer that a buyer, if he be an efficient one, is about the busiest man to be found; and particularly is this true in a manufacturing establishment. He therefore has very little time to acquaint himself with the detailed requirements to be met by the material which he buys, and he has still less time to become familiar with all the uses to which this material is to be put.

To the young buyer who has an ambition to become a purchasing agent in the broad sense of the term, a card index system is indispensable. It is invaluable to him, because by its use he is able to conduct his buying in less time than was formerly required. He will thus have the time in which to become familiar with the detailed requirements which must be met by the material which he buys. And he will in a short time know the minutest demands which his materials must satisfy. His card index system gives him a far more intelligent and comprehensive idea of quantities required, prices paid and deliveries made than he can get in any other way. As a result, his orders will naturally be more intelligently placed and his specifications more accurately made. He will save himself a deal of worry, and will be in a position to save his employers money by enabling them to run "long" or "short" as market and other conditions dictate.

The following is a card index system admirably adapted to the purchasing department of a manufacturing company.

The equipment comprises one four-drawer cabinet in which the card records are kept, one every-day file (indexed 1 to 31) and an order block. A few guide and tab cards are necessary for indexing the record drawers, and these will vary from time to time as the demands on the department grow. The majority of them, however, remain constant.

Three sets of alphabetical guides, together with a couple of special sets, are sufficient to handle the volume of business carried on in one establishment.

The entire office equipment necessary is shown in the accompanying reproduction of a photograph, Fig. 1. The everyday file referred to is on the left of the desk, and is made up of a series of thin cardboard sheets, which are bound in the back and indexed down the front—1 to 31—thus giving space between the leaves for papers which are to come up for attention each day of the month. This file is consulted the first thing every morning.

FIG. 1. PURCHASING AGENT'S OUTFIT.

FILE UNDER ..... ORDER No. 3130 COST @ ..... $ .....

THE EMERSON ELECTRIC MFG. CO.
MAKERS OF SMALL POWER AND FAN MOTORS.

St. Louis, Oct. 1 1901

To The Bridgeport Brass Co. Bridgeport Conn.

Please Ship Nov. 1 Via fast frt.

		DATE AND NO. DEL'D.
600#	#22 H H Sheet Brass	
	12" wide	

AND CHARGE TO THE ACCOUNT OF

REQUISITION BY Jak — THE EMERSON ELECTRIC MFG. CO. Per L — ACK'D — WILL SHIP — DEF. DATE

INV'C REC'D ..... WROTE TO BRING / FORWD SHIPMT \ SHOULD / BE HERE \

THIS MATL. MAKES 2800 B. CARRIES / US TO \ Jan. 1 CORRESPONDENCE, OVER.

American Machinist

FIG. 2. RED TICKET AS SENT TO RECEIVING CLERK.

FILE UNDER ..... ORDER No. 3130 COST @ ..... $ .....

THE EMERSON ELECTRIC MFG. CO.
MAKERS OF SMALL POWER AND FAN MOTORS.

St. Louis, Oct. 1 1901

To The Bridgeport Brass Co. Bridgeport Conn.

Please Ship Nov. 1 Via fast frt.

		DATE AND NO. DEL'D.
600#	#22 H H Sheet Brass	11/6 600#
	12" wide	OK K

RECEIVED NOV. 6 1901 KMCE STOCK CLERK

AND CHARGE TO THE ACCOUNT OF

REQUISITION BY Jak — THE EMERSON ELECTRIC MFG. CO. Per L — ACK'D — WILL SHIP — DEF. DATE

INV'C REC'D ..... WROTE TO BRING / FORWD SHIPMT \ SHOULD / BE HERE \

THIS MATL. MAKES 2800 B. CARRIES / US TO \ Jan. 1 CORRESPONDENCE, OVER.

American Machinist

FIG. 3. RED TICKET AS RETURNED TO PURCHASING DEPARTMENT BY RECEIVING CLERK AFTER GOODS HAVE ARRIVED.

The order block, shown in the center of the disk, is made up in quadruplicate form. The first, or top, sheet is of red tissue paper. The second sheet is of white medium weight paper. The third sheet is of thin, unruled scratch paper. The fourth sheet is a card of light index record card stock.

All are printed alike except the third or memorandum sheet, on which nothing but the serial number of the order appears. A slight omission is also made on the second sheet. This second sheet goes to the firm of whom the purchase is made, and to whom the omitted portion is of no interest.

Between each of the sheets is placed a piece of carbon paper, which insures the making of four identical copies of the order. The first goes to the receiving clerk; the second constitutes the order, and is mailed to the party from whom the pur-

ORDER No. 3130

THE EMERSON ELECTRIC MFG. CO.
MAKERS OF SMALL POWER AND FAN MOTORS

St. Louis, Oct. 1 1901

The Bridgeport Brass Co. Bridgeport Conn.

Please Ship Nov. 1 Via fast frt.

		DATE AND NO. DEL'D
600#	#22 H H Sheet Brass	
	12" wide	

AND CHARGE TO THE ACCOUNT OF

REQUISITION BY Jak — THE EMERSON ELECTRIC MFG. CO. Per L

Please acknowledge receipt of this order immediately, and state definitely when shipment will be made.
Enter number of this order on invoice
Send statement monthly. 2800 B. Jan. 1 American Machinist

FIG. 4. WHITE TICKET OR ORDER AS SENT TO PARTY FROM WHOM GOODS ARE ORDERED.

3130

Oct. 1 01

The Bridgeport Brass Co. Bridgeport Conn.

Nov. 1 fast frt.

600# #22 H H Sheet Brass

12" wide

Jak L

2800 B. Jan. 1

American Machinist

FIG. 5. MEMORANDUM TICKET FOR THE PURCHASING AGENT'S EVERYDAY FILE.

FILE UNDER ORDER No. 3130 COST @ $

THE EMERSON ELECTRIC MFG. CO.
MAKERS OF SMALL POWER AND FAN MOTORS.

St. Louis, Oct. 1 1901

To The Bridgeport Brass Co. Bridgeport Conn.

Please Ship Nov. 1 Via fast frt.

		DATE AND NO. DEL'D.
600#	#22 H H Sheet Brass	10/6 605#
	12" wide	

AND CHARGE TO THE ACCOUNT OF

REQUISITION BY Jak — THE EMERSON ELECTRIC MFG. CO. Per L

ACK'D 10/10 WILL SHIP As Ordered DEL. DATE Oct. 30 SHOULD BE HERE Nov. 10

INV'C REC'D NOV. 2 1901 WROTE TO BRING FOR'WD SHIP'MT 10/26

THIS MATL. MAKES 2800 B. CARRIES US TO Jan. 1 CORRESPONDENCE OVER.

American Machinist

FIG. 6. THE RECORD CARD FOR THE FILING CASE.

FILE UNDER Brass Sheet ORDER No. 3130 COST @ 15 5/10 $ 93.17

THE EMERSON ELECTRIC MFG. CO.
MAKERS OF SMALL POWER AND FAN MOTORS.

St. Louis, Oct. 1 1901

To The Bridgeport Brass Co. Bridgeport Conn.

Please Ship Nov. 1 Via fast frt.

		DATE AND NO. DEL'D.
600#	#22 H H Sheet Brass	10/6 605#
	12" wide	

FREIGHT CHARGES Pre Pd EXPRESS " TELEGRAPH "

BILL PASSED 10/10 93.17 L FOR PAYMENT

AND CHARGE TO THE ACCOUNT OF

REQUISITION BY Jak — THE EMERSON ELECTRIC MFG. CO. Per L

ACK'D 10/10 WILL SHIP As ordered DEL. DATE Oct. 30 SHOULD BE HERE Nov. 10

INV'C REC'D NOV. 2 1901 WROTE TO BRING FOR'WD SHIP'MT 10/26

THIS MATL. MAKES 2800 B. CARRIES US TO Jan. 1 CORRESPONDENCE OVER.

American Machinist

FIG. 7. THE RECORD CARD AS FILED AWAY AFTER TRANSACTION IS COMPLETE.

chase is made; the third goes to the every-day file, to come up from time to time until the order is properly filled; the fourth—the record card—goes into the drawer of the cabinet marked "Ordered," and carries with it notations made from time to time, thus making a permanent record of the entire transaction.

The handling of one order will show the system in operation. The top, red sheet, Fig. 2, goes to the receiving clerk in the department where the brass will be received, and is held by him in an alphabetical postal file under the firm name "B" (Bridgeport Brass Company). Thus by referring to his file the receiving clerk knows constantly what is ordered and about when to expect it in.

When the brass is received, the quantity received is noted, together with the date of its receipt, on the red ticket by the receiving clerk, who signs and returns the "red" to the purchasing department, filled out as shown in Fig. 3.

The purchasing department notes the fact that this brass is received and records the amount and date of its receipt on the record card which is being held, for the time being, under the firm name B (Bridgeport Brass Company) in the purchasing agent's cabinet in the drawer marked "Ordered."

The second or white sheet, Fig. 4, is mailed to the Bridgeport Brass Company.

The third or unruled memorandum sheet, Fig. 5, goes into the every-day file six days after the date of the order, in this case October 7. On October 7 this memorandum is automatically brought to the purchasing agent's attention when he opens his every-day file that morning. By October 7 this order for sheet brass should have been acknowledged, and if it has not been acknowledged, a form letter goes out after the acknowledgment requesting definite information that prompt shipment will be made as called for November 1. The fact of having written this form letter is noted on the memorandum sheet and also on the record card of the same number, which is still in the "Ordered" drawer of the cabinet under B.

As soon as acknowledgment of the order is received, notation to that effect, together with date of the acknowledgement, is noted on the record card, as shown in Fig. 6.

As soon as the material itself is received, the record card goes from the "Ordered" drawer of the cabinet to the drawer marked "Received," again being filed under the firm name B, and remains there until the invoice covering the shipment is received. The red slip from the receiving clerk, when showing that material has been received, is held by the purchasing department in an alphabetical postal file under the firm name B, where it awaits the arrival of the invoice covering. When the invoice is in, the red slip is pasted to it and the invoice is ready to be approved for payment.

If, on October 7, when the memorandum comes up, the order has already been acknowledged, the memorandum is put forward in the every-day file to six days prior to the shipping date, in this instance October 26. On this date the memorandum will again automatically come before the purchasing agent, who will send out a letter asking reassurance that the brass will come forward on time. The writing of this letter is noted on the memorandum and also on the record card. The memorandum is filed forward another six days to November 1, by which time a reply to the last letter should have been received, and if it has not been received, the memorandum being brought to the purchasing agent's attention at this time gives him a chance to make arrangements which will prevent any diminution in the factory output which is dependent on the sheet brass. *Thus the purchasing agent is able to prevent a possible loss which would fall upon his com-*

pany by reduced output due to delayed shipment of ordered material.

The memorandum now goes forward to six days *after* shipment should have been made, in this case to November 6, and when it comes up on November 6 an invoice covering the shipment should have been received as shown by notation already made on the record card at the time when the invoice came in; also by its presence in an alphabetical every-day file, having been filed under B in suspense, awaiting the arrival of the material on which it applies. If the invoice has not been received, the Bridgeport Brass Company are wired concerning the order, and proper action taken. If the invoice has been received, there is no reason why the brass should not come to hand a few days later, and the memorandum is therefore placed a few days further along in the every-day file, say, to November 9, and in case the shipment has not then been received the Bridgeport Brass Company are wired to trace their shipment by wire, and the memorandum is again moved forward until the material is at hand.

Whenever the memorandum comes up for attention and the material has already been received, the memorandum is marked "Received," and is placed forward in the every-day file to such date as will insure the ordering of this material again at the proper time, thereby avoiding any chance of its being forgotten. *Thus the necessity of cutting down factory output on account of proper material not having been ordered is guarded against.*

While in many lines of business it is not necessary to chase up material as closely as here outlined, yet in many manufacturing industries, and particularly where the product is a seasonable one, it is very necessary to run close to the output; and in such establishments this "tickler" scheme is a valuable one, as by its use delays all along the line are prevented.

The above method of handling these memorandum "ticklers" cares for any number of items. And as each comes up automatically, each will receive proper attention at the right time, thereby relieving the strain on the purchasing agent and setting him free to become more efficient in his position along other lines.

The record card, Fig. 6, not only carries a copy of the order, but bears a permanent record of each and every transaction. It shows the material received, together with the date of its receipt. It carries the price paid for the material which it covers, and is therefore valuable as a means of checking all future invoices.

As no bills are passed without this record having been stamped "Passed for payment," the record card effectually prevents more than one invoice being paid for the same material.

This record card is of value to the purchasing agent when placing future orders, as on it he has before him a complete record of the previous order, and is able to judge about what to expect in the way of prompt delivery on the next order, and also knows about how much of this No. 22 H. H. sheet brass, 12 inches wide, should be ordered at one time and from whom the last lot was ordered. He also has the market price of this brass at the date of the last order.

The record card is the permanently important part of the order block, and is handled as follows: It first goes into the drawer of the cabinet marked "Ordered," being filed under the firm name B, and, as already stated, remains here until the brass is received, and the red ticket O. K.'d by the receiving clerk and returned to the purchasing department, where notation, showing the amount of brass received and date of its receipt, is made from the red on to the record card, as before stated.

The record card is then carried to the drawer marked "Received," where it is again filed under the firm name B. It remains here until the invoice covering it is received. When the invoice is received and "red" pasted on to it it is O. K.'d for payment by the purchasing agent, who notes on the record card the price paid, together with the total amount of the invoice. The record card is then stamped "Passed for Payment" and the invoice is audited.

If it is desired to show transportation and other sundry charges, a rubber stamp impression is made for that purpose across the face of the record card.

The record card is now filed away for future reference under Brass—Sheet, as indicated in the open drawer of the cabinet. We thus have in this final file all orders for sheet brass in one place. All notations have been made on this record card from original papers, which, together with the fact that the card itself bears the original order, makes it nearly impossible for errors to creep into the record; and errors of transcription are of very frequent occurrence in systems where any great number of items are handled.

As the memorandum "tickling" scheme automatically keeps orders in hand, so *marginal references on the record cards when filled in from time to time make a complete material cost system which is automatically kept up to date, and which requires very little labor at any one time.*

In addition to making it impossible to pay the same bill twice by means of the record cards having been previously marked "Paid," this system again stops duplicate invoices at the purchasing department, because there will be no red slip to paste on the invoice, it having already gone through with the first bill.

The necessity of having a regular form receipt slip signed and pasted to every invoice tends to prevent payment for material different in any way from what was ordered or other than was actually received by the receiving clerk.

This system enables the purchasing agent to get after invoices which do not naturally come through on time, in which case the auditing department is never up to date. With this system in operation the purchasing agent has constantly before him receipts for material in the house, and if an invoice does not come along within a reasonable time he can go after it.

The system is appreciated by the management of any corporation on account of its simplicity, as anyone at all familiar with the requirements of the establishment can carry on the purchasing department in the absence of its agent, and can carry it on in a thoroughly systematic manner.

The system is complete in detail, *the records being made while the items handled are live issues,* so that nothing is left to be worked up "at some convenient season" which never comes.

While at first reading this system may appear to have a semblance of "red tape," still, in practice, it is found to work up in a very satisfactory manner.

The Metric System Work Trouble.

The following is from the report of United States Consul-General Skinner, of Marseilles, France:

"An incident occurred during the year which is worth noting, as illustrating the desirability of the adoption of the metric system in the United States, which, except Great Britain, is the only important manufacturing nation still employing the old system. In August of last year the United States naval collier 'Scindia' arrived at this port, with boiler tubes burnt out, and under urgent orders to proceed to Manila. The ship came to Marseilles, as it was considered, and in fact was, the port best equipped to make the absolutely essential repairs. Every facility was offered for the prompt refitting of the boilers by local contractors, but it was found that all the tubing in the city had been manufactured in France, and according to metric dimensions, and none of it could be utilized in the 'Scindia's' boilers without forcing the shells. There was the variation of a hair's breadth in the dimensions, but it was sufficient to prevent the work from being accomplished, and orders had to be cabled to the United States for material, which was brought over on one of the German steamers—probably at express rates—and delivered at Naples, where the repairs were eventually carried out. The ship was delayed two or three weeks, in consequence of the fact that her boilers had been built upon a scale of feet and inches, while European tubing was manufactured according to the metric system."

If any French steamer wants new tubes in a United States port we will guarantee that she shall have them without sending to France for them, though of course the fact remains that it would be better if tubing all over the world were made to the same standard or system of measurement.

Spiral Gears—III.

BY F. A. HALSEY.

FINAL SOLUTION WITH UNCHANGED CENTER DISTANCE.

If the center distance cannot be varied, the condition of things is shown in Fig. 12. Having found that the provisional normal helixes will not contain an exact number of teeth, and cut them off and obtained the smaller circumferences $a\,b'$ and $a\,c'$ of Fig. 10, the problem becomes to find a new value of α, indicated in Fig. 12, as α' which shall give such diameters as to restore the old center distance. That is, $a\,b'' + a\,c''$ of Fig. 12 must be equal to the original $a\,b + a\,c$ of Fig. 10. It will be seen by a glance at Fig. 12 that the reduced value of α increases the diameter of the driver, but reduces that of the follower.

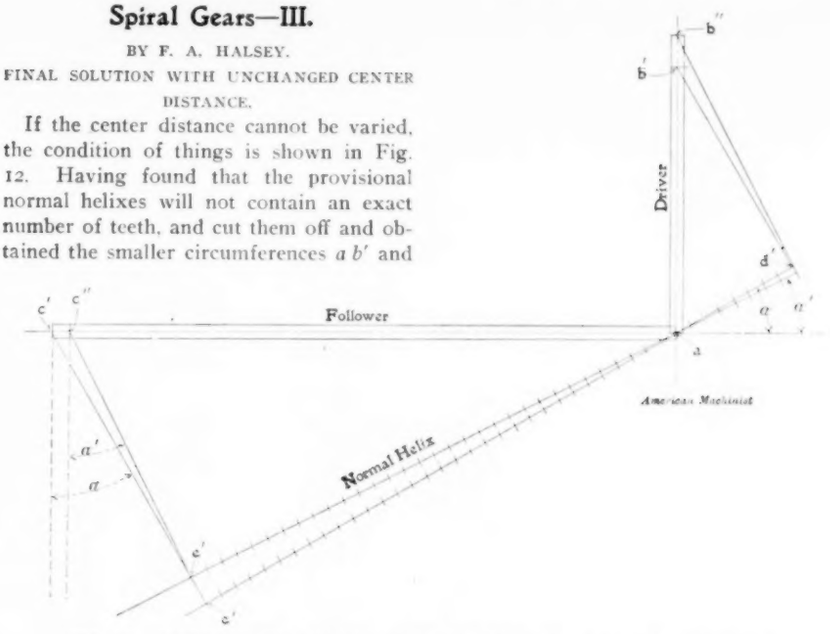


FIG. 12. ADJUSTING THE DIAMETERS WHEN THE CENTER DISTANCE IS FIXED.

It is probable that the correct angle and diameters for this case can be found only by trial. From (4) we have:

$$d_1 = \frac{l_1}{\pi \sin. \alpha} \qquad (7)$$

and from (5)

$$d_2 = \frac{l_2}{\pi \cos. \alpha} \qquad (8)$$

We also have:

$$d_1 + d_2 = 2C;$$

that is

$$\frac{l_1}{\pi \sin. \alpha} + \frac{l_2}{\pi \cos. \alpha} = 2C,$$

which easily reduces to:

$$1 + \frac{l_2}{l_1} \tan. \alpha = \frac{2C}{\frac{l_1}{\pi}} \sin. \alpha \qquad (9)$$

To solve this equation we know that $\frac{l_2}{l_1}$ = the speed ratio = 4 and in the preceding article we found that final $\frac{l_1}{\pi} = 1.333$. Substituting these values and the value of C, the only unknown quantity is α, but, from the form of the equation, α can be found only by trial and error, the result of each trial being a closer and closer approximation to the truth. The operation is simple enough, but it involves the repeated multiplication of decimals. For the earlier steps a slide rule will greatly abbreviate the work, while with a Sexton's omnimeter an accuracy can be obtained sufficient for all the steps and a piece of drudgery be converted into an exhilarating chase. The results which follow were obtained with an omnimeter. Trying the provisional angle of 30 degrees in order to note the result and making the substitutions in (9) we obtain:

$$1 + 4 \times .577 = 6.702 \times .5$$

or

$$3.308 = 3.351.$$

This is not correct, as we knew it would not be. The right-hand number is larger than the left-hand number, which will always be the case if our trial value of α is too large, and *vice versa* if it is too small. Trying 28 degrees we obtain:

$$1 + 4 \times .532 = 6.702 \times .469$$

or

$$3.13 = 3.145.$$

The right-hand number is still too large, showing 28 degrees to be too large. Trying 26 degrees we obtain:

$$1 + 4 \times .488 = 6.702 \times .438$$

or

$$2.953 = 2.935.$$

The right-hand number is now too small, showing that 26 degrees is too small. Trying 26 degrees 30 minutes we obtain:

$$1 + 4 \times .499 = 6.702 \times .446$$

or

$$3. = 2.99$$

This angle is still too small, though obviously very nearly correct. Trying 26 degrees and 40 minutes we obtain:

$$1 + 4 \times .502 = 6.702 \times .449$$

or

$$3.01 = 3.01.$$

Within the limits of accuracy of the omnimeter this is correct, and as that instrument shows the effect of so small a change in the angle as 10 minutes the result is obviously close enough. It agrees with Mr. De Leeuw's determination. Having found the angle we are now in shape to find the final diameters. Substituting in (7) and (8) we obtain:

$$d_1 = \frac{1.333}{.4488} = 2.971$$

and

$$d_2 = \frac{5.333}{.8936} = 5.968$$

and $5.968 + 2.971 = 8.939$, which is twice the required center distance as closely as can be expected.

GRAPHICAL SOLUTION WITH UNCHANGED CENTER DISTANCE.

These determinations may also be made graphically, as shown in Fig. 13, which repeats the construction of Fig. 11 up to the finding of the provisional values of $a\,h$ and $b\,h$.

In Fig. 11 h is a fixed point, while a and b were not. In the present case a

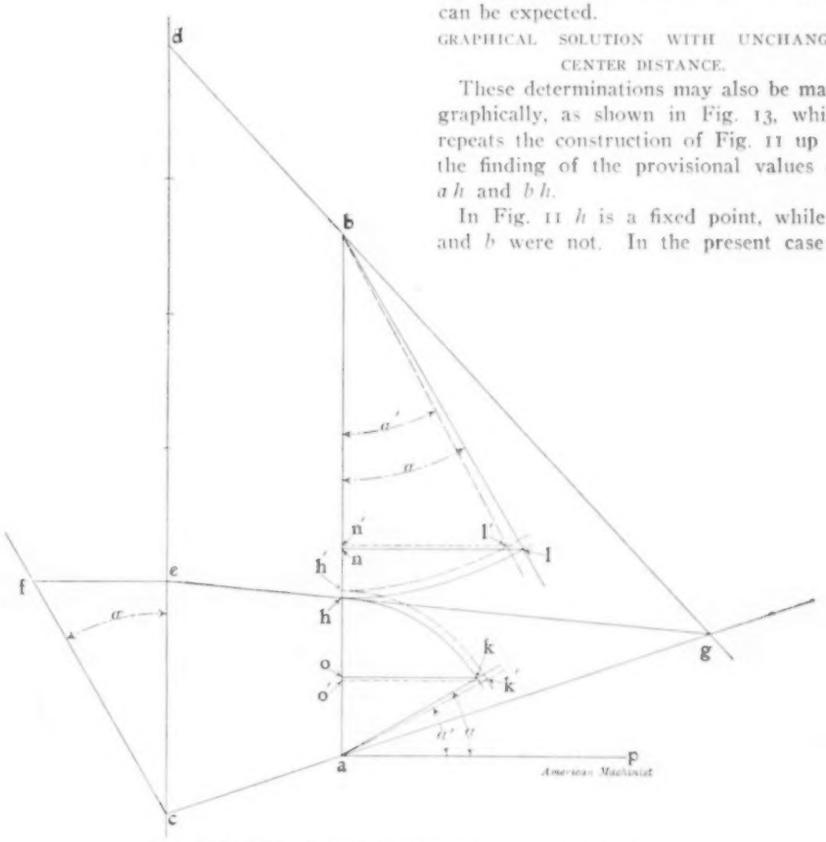


FIG. 13. GRAPHICAL SOLUTION WITH FIXED CENTER DISTANCE.

and b are fixed, but h is not, and to find $\frac{l_1}{\pi}$ and $\frac{l_2}{\pi}$ in the present case it is better to lay off α at a and b instead of at h, as was done in Fig. 11. Therefore lay down α at a and b, as shown, and strike arcs

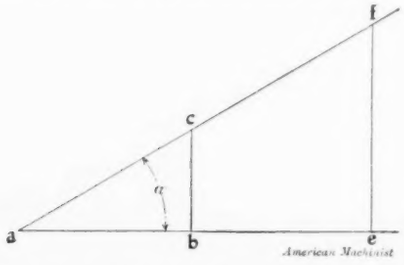


FIG. 14. FINDING THE PITCH OF THE TOOTH HELIX.

$h\,k$ and $h\,l$. Draw $k\,o$ and $l\,n$, giving the provisional values:

$$a\,o = \frac{l_1}{\pi}$$

$$b\,n = \frac{l_2}{\pi}$$

Measure these distances and multiply them by the diametral pitch number—in this case 6—to find the numbers of teeth going with the assumed value of α. If, as is usually the case, the products are not whole numbers, take the nearest whole numbers having the ratio of the desired speeds, divide them by the diametral pitch number and obtain the corrected values of $\frac{l_1}{\pi}$ and $\frac{l_2}{\pi}$. Lay off $a\,o'$ and $b\,n'$ equal to these corrected values. Assume a new trial angle, indicated as α', and lay it down at a and b. Draw $o'\,k'$ and $n'\,l'$, and through the intersections k' and l' dr w the dotted arcs. If these arcs meet in tangency at h', then we have the final values:

$$a\,h' = d_1$$

and

$$b\,h' = d_2.$$

If the arcs do not thus meet in tangency, assume another value for α and try again.

Graphical methods are sufficiently accurate for many purposes, especially if laid out upon an enlarged scale, and if it is remembered that if the values used for $\frac{l_1}{\pi}$ and $\frac{l_2}{\pi}$ are a little short of the true values, the shortage will be divided among the teeth with the only result of a little slackness in the teeth.

FINDING THE PITCH OF THE TOOTH HELIX.

It now only remains to find the pitch of the tooth helixes in order to set up the machine. In Fig. 9 let

p_1 = pitch of tooth helix of driver,
p_2 = pitch of tooth helix of follower;

then

$$p_1 = c_1 \text{ tan. } \alpha,$$
$$= \pi\, d_1 \text{ tan. } \alpha,$$

and

$$p_2 = c_2 \text{ cot. } \alpha,$$
$$= \pi\, d_2 \text{ cot. } \alpha.$$

Inserting the final values of d_1 d_2 and α we obtain:

$$p_1 = \pi \times 2.971 \times .502,$$
$$= 4.684,$$

and

$$p_2 = \pi \times 5.968 \times 1.991,$$
$$= 37.33.$$

These values may be found graphically as in Fig. 14. Lay down α and make $a\,b = \pi\, d_1$ when $b\,c = p_1$. Find $e\,f = \pi\, d_2$ and $a\,e = p_2$.

SPECIAL SOLUTION FOR A HELIX ANGLE OF 45 DEGREES.

Remembering that $\frac{l_2}{l_1} = \frac{r_1}{r_2}$, the latter fraction may be substituted for the former in (9) together with the assumed value of α and the provisional value of $\frac{l_1}{\pi}$ be thus found without first finding the provisional values of d_1 and d_2. The final values of d_1 and d_2 may then be found from (7) and (8). Such a solution is in some respects neater than the one given, but it is believed to be less easily followed and comprehended, and, moreover, it does not, for the general case, furnish the basis of so good a graphical solution. This method is at its best in the case of a helix angle of 45 degrees and the fact that, for this case, tan. α in (9) becomes 1 makes that equation the basis of a neat graphical solution for this special case. This angle does not differ from any other in requiring a change in the center distance if it is to be adhered to. In the nature of the case, if we deny ourselves the liberty of changing the angle, the only recourse is to correct length of the helix by changing the diameters. As this angle is used more than any other—perhaps more than all others—this solution for it is given.

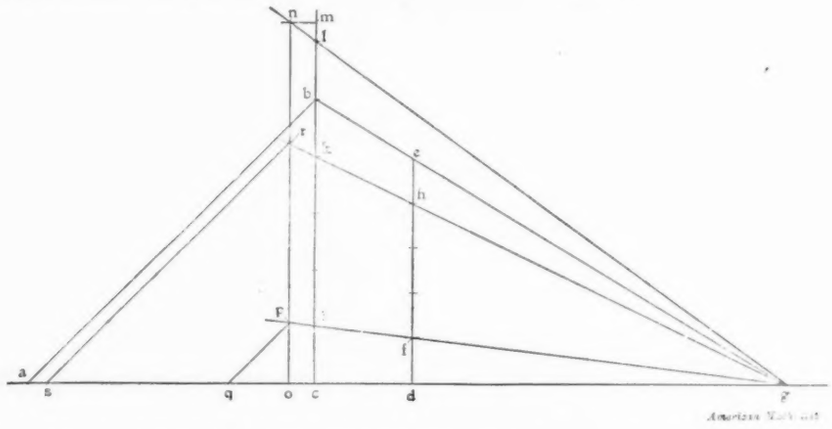


FIG. 15. SPECIAL GRAPHICAL CONSTRUCTION FOR A HELIX ANGLE OF 45 DEGREES.

Remembering that in (9) $\frac{l_2}{l_1} = \frac{r_1}{r_2}$, that tan. $45° = 1$ and that sin. $45° = .7071$, that equation becomes *for this angle only:*

$$1 + \frac{r_1}{r_2} = \frac{1.4142\ C}{\frac{l_1}{\pi}}$$

which may be made to read:

$$\frac{l_1}{\pi} = \frac{1.4142\ C}{1 + \frac{r_1}{r_2}} \qquad (10)$$

Inserting sin. $45° = .7071$ in (7) we have:

$$d_1 = \frac{\frac{l_1}{\pi}}{.7071} \qquad (11)$$

Equations (10) and (11) are all that are needed for solving any case having this helix angle.

Taking up Mr. De Leeuw's problem again and solving it for this angle, we have from (10) for the provisional value:

$$\frac{l_1}{\pi} = \frac{1.4142 \times 4.468}{1 + 4}$$
$$= 1.2637.$$

Multiplying this by the diametral pitch of the cutter to be used, we obtain:

$$1.2637 \times 6 = 7.58$$

as the provisional number of teeth in the driver. As it is an impossible number, we select 8 as the number of teeth and, dividing it by 6, we obtain:

$$\frac{8}{6} = 1.333$$

as the final value of $\frac{l_1}{\pi}$. Substituting this in (11), we obtain:

$$d_1 = \frac{1.333}{.7071}$$
$$= 1.885$$

as the final value of the diameter of the driver. The diameter and number of teeth of the follower for an angle of 45 degrees are found by multiplying the diameter and number of teeth of the driver by the speed ratio. That is:

$$d_2 = 1.885 \times 4$$
$$= 7.540$$

and

number of teeth in follower $= 8 \times 4$
$= 32$

Finally

$$d_1 + d_2 = 1.885 + 7.54$$
$$= 9.425$$
$$=$$ twice the final center distance.

GRAPHICAL SOLUTION FOR AN ANGLE OF 45 DEGREES.

The special graphical solution for this case is given in Fig. 15:

Lay down the base line and at a lay off $a\,b$ at an angle to it of 45 degrees. Make $a\,b = 2\,C$—in this case $8\frac{5}{6}$ inches—and draw the perpendicular $b\,c$. At any convenient point draw the perpendicular $d\,e$,

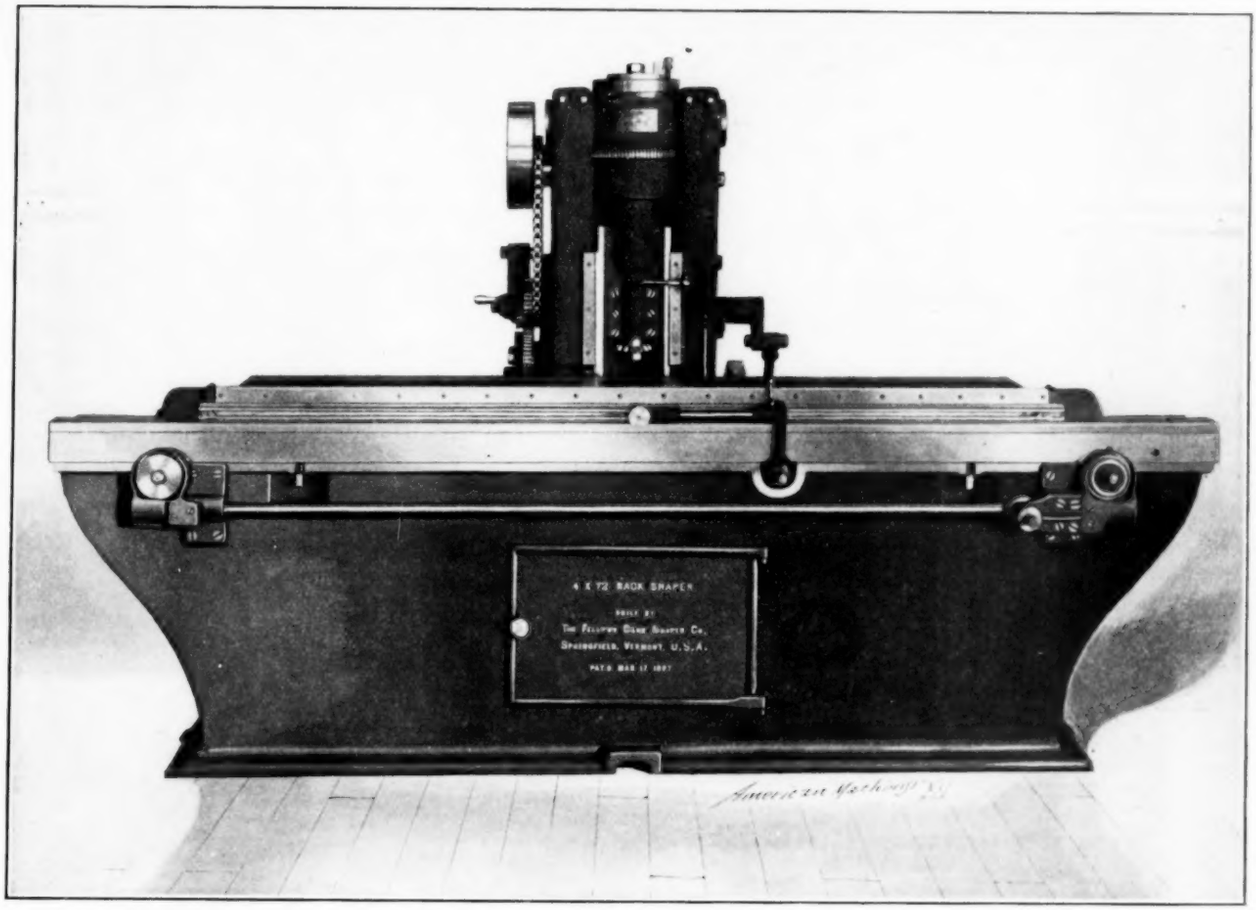


FIG. 1. FRONT VIEW OF FELLOWS RACK SHAPER.

making $d\,f = 1$ inch and $f\,e$ as long in inches as will represent the speed ratio; that is, in the present case, make $f\,e = 4$ inches. Draw $b\,e$ and extend it till it meets the base line at g. Draw $f\,g$ through the first inch from d and $h\,g$ through the fourth inch, giving:

$c\,i$ = the provisional value of $\frac{l_1}{\pi}$

and

$c\,k$ = the provisional value of $\frac{l_2}{\pi}$

Step off $c\,i$ from c as many times as will represent the diametral pitch number—in this case 6—giving l. Measure $c\,l$, which in inches gives the provisional number of teeth in the driver. If not a whole number of inches in length, as it usually is not, locate m such that $c\,m$ equals the nearest whole number of inches—in this case 8, which is the final number of teeth in the driver. Draw $g\,l$, $m\,n$, $n\,o$, $p\,q$ and $r\,s$, and we have:

$o\,p$ = final $\frac{l_1}{\pi}$,

$o\,r$ = final $\frac{l_2}{\pi}$,

$p\,q$ = final d_1,

$r\,s$ = final d_2,

$p\,q + r\,s$ = twice the final center distance.

The number of teeth in the follower equals those in the driver multiplied by the speed ratio.

(Conclusion.)

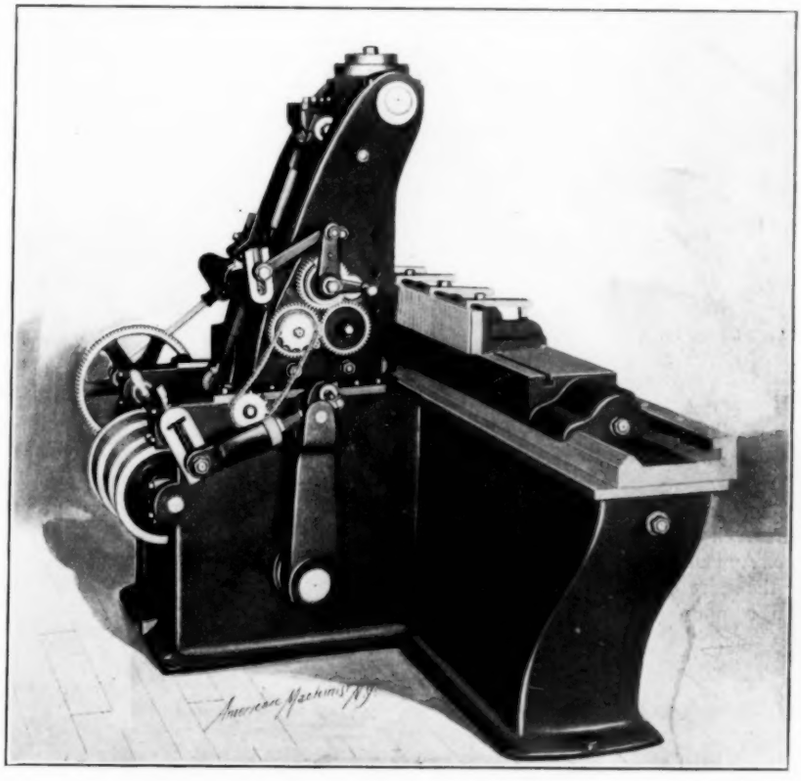


FIG. 2. END VIEW OF RACK SHAPER.

The Fellows Rack Shaper.

Our readers are well informed regarding the principles and construction of the Fellows gear shaper, and will be correspondingly interested in the latest application of the same principle to rack cutting, which we illustrate herewith.

The rack shaper acts upon precisely the same principle, and, in fact, employs the same cutter as the gear shaper. A straight-line motion of the rack blank obtained with slides is substituted for the rotary motion of the gear blank about a supporting arbor, and about this central change are arranged such other changes as are desirable or necessary.

Fig. 1 of the accompanying illustrations shows a front view, and Fig. 2 an end view of the machine. Fig. 3 is a cross-section, and Fig. 4 is a sectional plan.

One of the changes referred to above lies in the method of separating the blank and the cutter during return stroke of the latter. With the gear cutter this is accomplished by moving the blank, but with the rack cutter it is obviously far more desirable to move the cutter spindle than the entire rack table, and this is accordingly done. A glance at Figs. 1, 2 and 3 will show how the entire operating ram head is swung upon trunnions which permit the entire slide and with it the cutter to have a limited swinging motion. The lower end of the main slide bears on an auxiliary guide, of which the position is controlled by a cam-actuated lever *A*, Fig. 3. During the downward or cutting stroke of the cutter the auxiliary guide is held rigidly against the inner face of the main frame, forming, in connection with this frame, an ordinary slide bearing, but during the return stroke the whole mechanism is withdrawn from the blank sufficiently to prevent the rubbing of the cutter, as shown in the small detail below and at the right of Fig. 4.

The method of driving the cutter in its rotary motion is similar to that used in the gear shaper through an index wheel and semi-circular slide. The cutter slide is given its reciprocating motion by a driving crank, bell-crank and pitman, as shown broken in Fig. 3, which also shows the method of connecting the index wheel with the feed screw whereby cutter and blank are rolled together and the rack teeth are generated from the cutter teeth. The slight motion of the worm when the cutter is withdrawn for the return stroke requires to be accommodated, and for this purpose the inclined feed rod is made telescopic. The rotary motion of this rod is transmitted through the other shafts and bevel gears shown to the spur gear *B*, which connects with gear *C*, and thus turns the feed screw nut. The feed may be in either direction, the reversal being accomplished through the tumble gears seen in Fig. 2. Quick return of the platen in both directions is provided, but its use is not contemplated in continuous work. After a set of blanks has been cut it is expected that the machine will be stopped, the cut racks removed and a second set of blanks placed in position, when the feed is to be reversed and the second set cut by feeding in the opposite direction.

In Fig. 1 a rod will be seen extending across the front of the machine. This rod operates two short cross screws, shown in Fig. 4, by which the adjustment for depth of cut is obtained. This depth is read to thousandths by a graduated dial.

Figs. 2 and 4 show a system of clamps for holding the rack blanks, which are adapted to a wide range of work, but for such cases as the cutting of a rack upon a heavy slide or other large piece, the clamps may be removed and the blank be bolted direct to the platen.

In addition to its basic principle of the generation of the teeth this system of rack cutter has two structural peculiarities. Of these the first is that no change gears are required for different pitches. Cutters of all pitches have the same pitch diameter, and as the relative motion of cutter and blank is simply that of a complete rack and gear in mesh, it follows that a motion which is correct for one pitch is correct for all. The second peculiarity is that there is no limit to the size of the gear which rotates the cutter. Where cutters of the usual type are used in rack cutting, the location of the cutter arbor parallel with the blank involves a driving gear which is smaller than the cutter, or, in lieu of that, a driving shaft which is longer than the longest rack to be cut. In the present case there is no such limitation, and the cutter driving gear will be seen to be in fact much larger than the cutter.

The illustrations are from a machine having a capacity to cut racks 6 feet long, but machines are made with capacities of

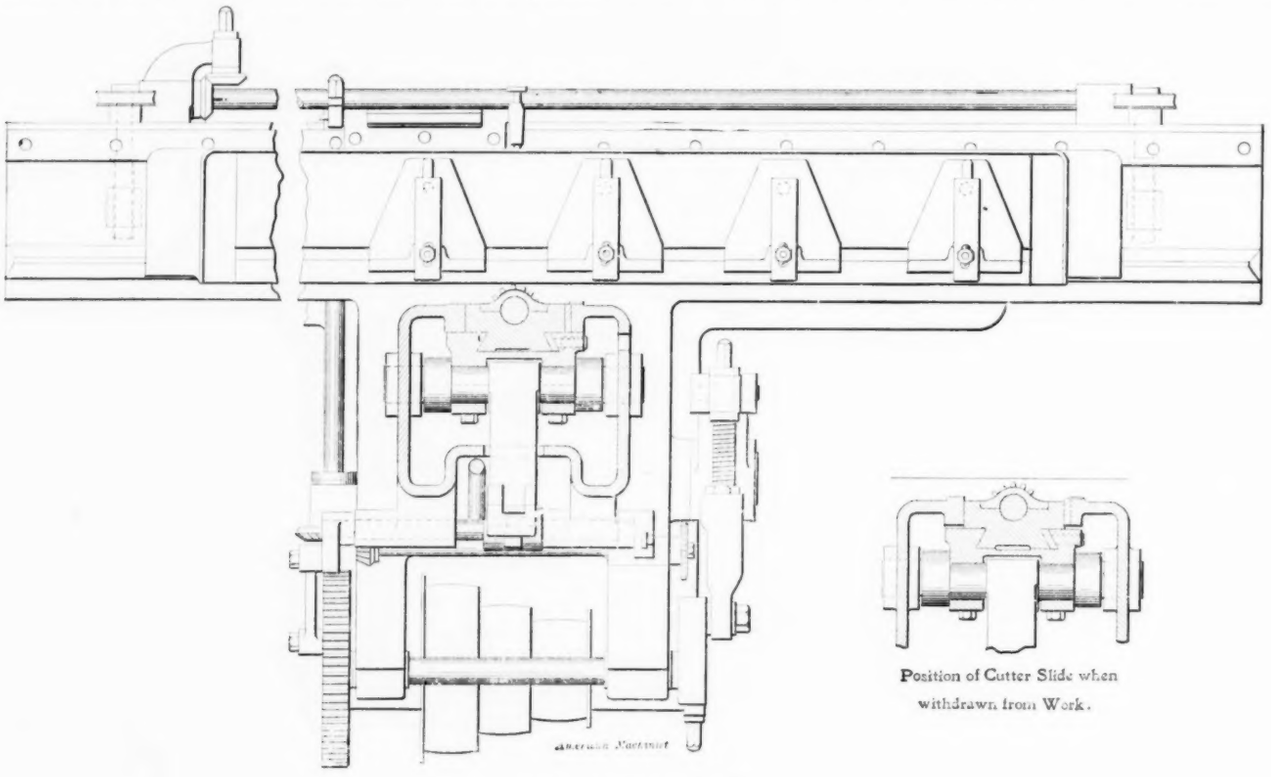


FIG. 4. SECTIONAL PLAN.

5, 6, 8, 10 and 12 feet. For use on steel a pump and oil pan are provided.

The machine is the product of the Fellows Gear Shaper Company, of Springfield, Vt.

Foreign Markets For American Oil Engines.

There are several markets now open to United States makers of oil engines. One of them is the

RUSSIAN MARKET,

which, in spite of present tariff difficulties, is worthy of attention. The dispute between the two governments, in the opinion of practical people, is not going to prove an eternal barrier between the countries concerned. There is certainly a growing demand in the Russian Empire for oil engines of large power, but these must be built to meet local wants. The chief of these are as follows: The engine must be simply constructed and yet adapted for working with the oil in its crude state. Various technical difficulties have to be overcome in producing a really perfect engine, but I learn that, in one instance at least, almost every objectionable feature has been overcome, and large numbers are being sold.

The development of the oil industry in Russia has caused a large demand for machinery, which British manufacturers have largely supplied. The steam engines used in that country are principally of British production, supplied, I may add, by a few English firms who have carefully studied local needs and national idiosyncrasies. The United Kingdom does a lot, also, in supplying the pumping machinery; but American houses have latterly obtained a decided foothold in consequence of being able to quote better prices and probably quicker delivery. Your exporters have scored a point by turning out lighter machinery, although of adequate strength, and by doing this they have reduced the weight of the machines and thus saved an enormous amount in customs duty. The Germans have managed to get hold of a deal of business in the equipment of large electrical power stations, used for supplying electricity as motive power on the oil fields. There is an opening, too, for oil engines in Russian butter factories, because in these establishments they frequently use at present horse gears instead of small and handy oil motors.

PALESTINE

offers a very good market for the supply of oil engines. The primitive chain pumps in the numerous orange groves of Jaffa are now being replaced by oil engines, the use of which has been found to be very economical, doing away with the use of mules and the costs rendered necessary by their keep. American makers, in trying to cultivate a trade with such a country as Palestine, must be prepared to encounter a great deal of passive opposition. The people want to see every day the actual benefit of, say, using an oil engine in their vineyards instead of the old-time way of drawing water by the aid of mules. As an illustration, I may mention that about three or four years ago a German firm tried to push an oil engine of 3 to 4 horse-

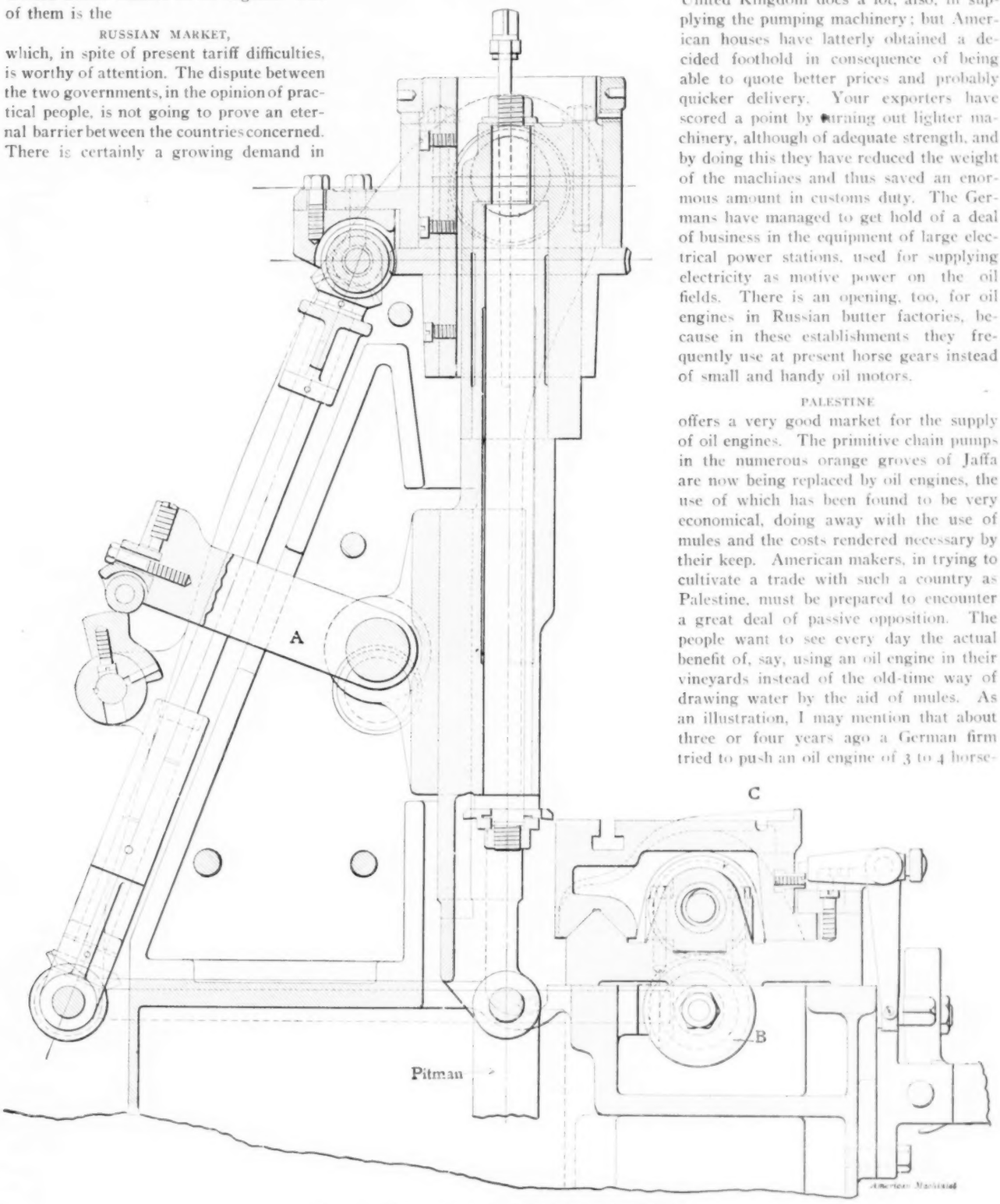


FIG. 3. CROSS-SECTION OF RAM HEAD AND PLATEN.

power for pumping water from the deep wells, by which means they saw it could readily be done more quickly than by mule power. The native cultivators viewed the whole matter with suspicion and would have none of the engines, until at last the pushing Germans put up an engine free of expense in one of the gardens, just to give the apathetic Orientals a practical demonstration. Of course the result was soon apparent and orders began to flow in. One of the chief difficulties at first was that the engines were made to pump up the water, but the pipes frequently became clogged with mud and sand at the bottom of the wells. The arrangement was easily altered, and by a simple adjustment of the belt, the old water wheel with its buckets is made to rotate and the water is raised as before, but at a very much greater speed. It is found that an oil engine will fill one of the larger reservoirs used in the country in six hours, at half the daily cost of keeping three or four mules. During the last two or three years quite sixty of these oil engines have been employed in the larger plantations, upwards of two-thirds being of German make, and the rest of British production. The makers of the latter type are increasing their trade, because they have been able to simplify the construction of their engine. This question of simplicity is of great importance, because the engines are invariably placed in charge of native laborers, who, I need hardly say, are not very expert engineers. The annual amount of the machinery trade in Palestine is about 280,000 francs, of which Great Britain takes 170,000 francs; France, 50,000, and all other countries, 60,000 francs.

TURKEY

is another likely market. I may state that a commencement has been made in Salonica with the introduction of petroleum and benzine engines, in which the smaller industries are showing more and more interest. Belgian engineering houses are trying hard to capture this market by pushing the sale of oil engines among the small millers in the interior of the country. The mechanism of the Belgian engines is very simple, but the parts are strong and they can easily be taken to pieces by an inexperienced man; while, of equal importance, they burn the common lamp oil which is very cheap in the country. The cost of the engines is low, and they are very economical in work. An engine of 3 horse-power requires only 300 grammes of petroleum per horse-power hour. Each of these engines is accompanied by a guarantee as to the power promised and the quantity of oil consumed. Quite a number of these engines have been sold in the different Macedonian villages.

There are several other very promising markets offering good opportunities for the sale of American oil engines, particulars of which may be given at a later date. Need I add that it is almost useless for an unknown firm of any nationality to try and get orders in any of the above-named countries by sending catalogs to importers, consuls, etc. In the case of a well-known firm, the result would be but small. The best way is to personally visit the country and get first-hand information on the spot. That is worth a lifelong correspondence, and a good deal of business of an additional character is often secured during such journeys, and data are obtained proving of great value in ways totally unexpected. Anyway, the days have passed when trade with people many thousands of miles away can be done in an apathetic way.

F. C. C.

Notes on Foundations.

BY GERALD E. FLANAGAN.

Foundation drawings might readily be made to represent the requirements more fully than many of them now do, and this is not the less true, because no matter how completely they may present the needs of the case, something must still be left to the discretion of those upon whom the execution of the work devolves, and by whom the character of the ground upon which the structure is to rest must be considered. Where a considerable variation exists between the loads which different portions of a structure impose upon the foundations, these loads should be plainly marked upon the drawing so that additional precautions may be taken in case the ground is exceptionally bad. It is not uncommon, in steel works especially, for a column to have to support ten times the load which is borne by an adjoining one of much the same general dimensions, and unless this fact is noted on the drawing this heavily loaded column, which may also chance to come upon very uncertain ground, may be built without any precautions being taken to provide for it, which cannot fail to result in an unequal settlement of the building. When calculating the loads bearing upon the soil, the weight of the piers themselves must not be neglected; and when, as sometimes happens, their depth in the ground becomes very considerable, the base area may require to be increased.

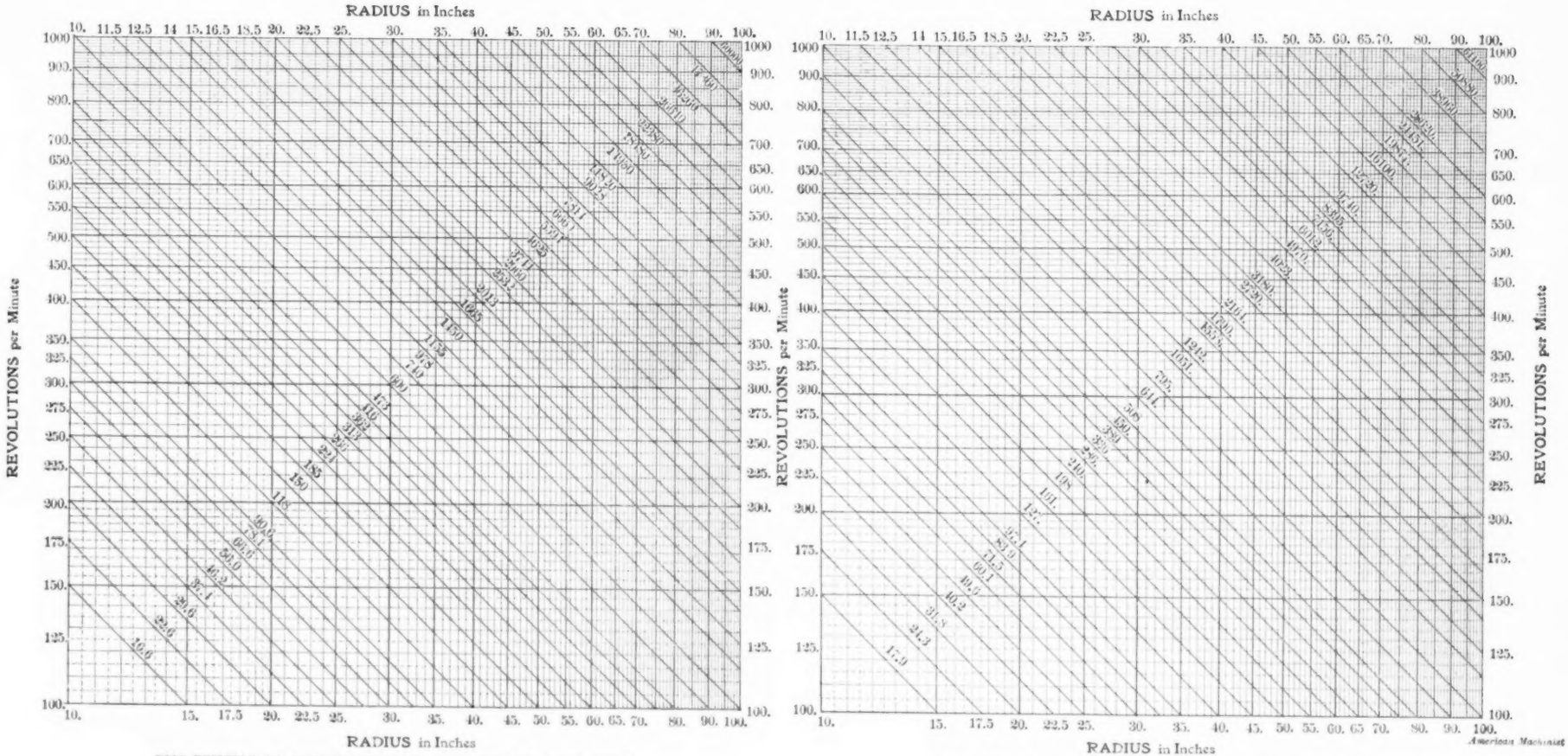
In cases in which it is impossible to provide adequate foundations immediately beneath a column, what is known as the cantilever construction is resorted to. This simply means that the column is carried upon the end of an overhung beam, which in turn is supported as near the column as practicable, the reaction at the other end being taken usually by building it in beneath another column capable of fully resisting its upward tendency. Notable examples of this construction occur in some of the many-storied buildings, where the columns are required to come close to the property lines, while the foundations must not project beyond them.

Another noteworthy example of the application of engineering principles to foundation construction is shown in the employment of the inverted arch. This is used in cases where high walls, or walls carrying heavy loads, require to have openings of large size, such as for main entrance, and where it is desired to prevent the weight of the wall above from coming as a concentrated load upon a limited area on either side of it. An inverted arch is built beneath the ground level connecting the two sides of the opening and having the same effect, so far as the pressure upon the soil is concerned, as a solid wall of equal weight. Where the depth of foundation is insufficient to form the inverted arch, a strong girder is sometimes used.

A matter of minor importance, upon which opinions differ, is whether dimensions should be given to the tip of the anchor bolts or to the under side of the nuts. The latter method was formerly most in vogue, the assumption being that the bolts were always hung in place from templets before the masonry was commenced, and that the upper side of the templet, being the same as the upper side of the casting, was the most definite place to measure to. Of late years, however, the tendency has been to give the distance from the top of the foundation to the tip of the bolt. This is done partly because it is easier to show on the drawing, the figures not being crowded into so small a space, because the length of bolt required is more readily checked up from the drawing, and also because it removes the necessity for any exercise of judgment upon the part of the masons building the piers, as to how much of the bolt should project above the nut. In certain classes of buildings, a special allowance is sometimes made to allow the columns to be raised slightly later to compensate for unequal settlement, and presumably the engineering force will possess the best means of determining how much is likely to be required for this purpose. Thick washers are often used beneath the nuts where this latitude is desired, to obviate the unsightly appearance of a long, projecting bolt; and when the columns are raised, thinner washers are substituted.

All sunken parts of foundations, such as flywheel pits, should have drain pipes. Foundations for hydraulic cylinders should be so constructed as to permit easy access to their supply pipes.

Anchor bolts are frequently built in boxes extending down 2 or 3 feet from the top of the foundation. This allows the bolts to be sprung a little to compensate for trifling errors in their setting or irregularities in the castings. This provision is most essential where the castings to be held are large and contain many bolt holes a considerable distance apart. Foundation washers must be made to hold the bolts from turning. Important foundations, such as those for rolling mills and large engines, are built with passage ways and hand holes to reach the lower ends of the bolts, which are made with cotters in place of heads, and, as they are boxed for their



RIM TENSION IN POUNDS PER SQUARE INCH FOR CAST IRON.

RIM TENSION IN POUNDS PER SQUARE INCH FOR STEEL.

Directions.—Read rim tension on that diagonal which passes through the intersection of the horizontal line representing the speed with the vertical line representing the radius. Rim tension for any speed or radius not plotted can be found by reading its value for 1-10 or 10 times the speed or radius and dividing or multiplying this value by 100. Thus rim tension at 10,000 R. P. M. and 4 inches radius is the same as at 1,000 R. P. M. and 40 inches radius = 11,820 pounds. Example: Find rim tension of a wheel running at 97 R. P. M. and having a radius of 190 inches. Take intersection of 970 R. P. M. and 19 inches radius, which gives 2,532 pounds for cast iron, or 2,720 pounds for steel.

entire length, are readily renewable in case of breakage. To facilitate replacement, the bolts are also made pointed upon the lower end and readily find their own way into the holes in the foundation washers. The washers for anchor bolts are of cast iron or of rolled steel plate. In the former case they are molded to any size and shape desired, with one or more cored holes for bolts and pockets to suit the bolt heads, or, at times, only a simple, straight projection to come beside the bolt head and prevent its turning. Flat steel plates have a narrow strip riveted to them at a proper distance from the hole to serve the same purpose. A simple and cheap form of washer and anchor bolts combined, for use where two bolts are required close together, as commonly occurs in light columns, consists of a plain, round bar, threaded for nuts on each end and bent into a "U" form, the horizontal part serving in place of a washer. Foundations for columns and machinery are usually stopped from ½ to ¾ inch below the exact level required, and the base plates are brought to the precise elevation by means of small wedges of steel, after which the intervening space is filled with cement grout, thus assuring a perfectly uniform bearing upon the entire surface.

Centrifugal Force Diagrams.

BY P. MULLER.

At page 647, volume for 1899, were published two diagrams of mine, which gave

the values of centrifugal force per pound of weight and the total rim tension per pound of weight could also be read from the diagrams.

Since then I have constructed the accompanying diagrams, which give the rim tension per square inch, one being arranged to read for cast iron and the other for steel or wrought iron.

The principal object in constructing these diagrams was to obtain the rim tension per square inch for a given metal in one reading at any radius or speed, without having to resort to laborious calculations. By plotting these on logarithmic paper (which is commercial) the rim tension lines become straight and intersect the lines representing speed and radius under the same angle. The diagram for steel will of course also serve for wrought iron, which has practically the same specific gravity as steel. The explanation and formula given on the face of the diagram should be perfectly clear, yet it may be argued that it would have been unnecessary on the curve for cast iron to plot values higher than the ultimate tensile strength of that metal, but the following example will show the reason for it. For instance, it is desired to know what the stress per square inch would be if a wheel of 9 inches radius were running at 5,500 revolutions per minute. Since 9 inches radius is not plotted directly, we take the intersection of 90 inches radius and 550 revolutions per minute, which does not alter the proportion, for the reason that rim tension is proportional to the square of the radius as well as to the square of the speed. The diagonal passing through this intersection shows 18,480 pounds rim tension, which is therefore the correct value for 9 inches radius and 5,500 revolutions per minute.

Had the speed been 550 revolutions per minute and the radius 9 inches, as before, we would divide the value just found by the square of 10 and obtain 184.80 pounds. Values not directly plotted can of course be easily interpolated as the rim tension lines are close together.

Letters from Practical Men

Minute Tube Work.

Editor American Machinist:

The various processes for forming split tubes, and the tools for the same having been quite fully treated in your columns at various times, I wish to submit samples of tubes of somewhat smaller caliber than those described hitherto. The tools for these tubes are practically the same as those described by Mr. Dougherty on page 1133, with such modifications as were necessary to adapt them for use in an automatic machine. The wire enclosed which passes freely through the smaller sized tubes is .020 inch diameter, and this size, of which there are two lengths, 27-32 and 17-32 inch respectively, is made at the rate of 100 per minute, while the slightly larger size, which is 13-32 inch long, runs at 135 per minute. The stock used is soft brass .004 inch thick, fed in a strip, the blanking and forming operations being performed continuously and automatically, one girl attending three or four machines.

This process, it is safe to say, is no infringement of the patented process claimed by Mr. Wilder on page 1214, as some of these machines are more than thirty years old and still doing good work, the making of tubes being merely a side issue, as they are just as well adapted to the manufacture of a large variety of metal goods, such as ferrules, washers, button backs, eyelets, etc.

"NEEDLE."

[It is much to be regretted that there seems to be no satisfactory way of showing our readers the tube samples above referred to. The writer has sent us more than a hundred of them, and they are not only as he describes them, but are a neater and cleaner job than might be inferred. The external diameter of the tubes is less than that of a pin such as the ladies use of the one-inch length. It takes nearly 20 yards of these tubes to weigh one ounce. —Ed.]

Tube Forming Dies.

Editor American Machinist:

At page 1214, Mr. Moses G. Wilder controverts some statements I made in an article on tube-forming tools at page 1133. He seems to find no fault with the methods described, but claims that they would do much more than I stated. It would have been easy for me to have asserted that they would do all he says, but I do not think they would. He certainly could not have read my article carefully when he says he finds no reason why the metal should be thick to make a tube. I was very explicit about the thickness, or the heavy and light gages, and remarked that the dividing line was hard to determine. I explained clearly how light and heavy gages could be used, and that much depended on the diameter of the tubes to be formed. Thus, if a tube had to be made ⅛ inch in diameter, IX tin would be heavy, but if a tube had to be made 1 inch in diameter, then IX tin would be too light; IC would be much lighter in proportion. It could not be formed without a mandrel, because the edges are too thin to butt against each other and stay butted under the pressure applied. They would slip past each other, because the metal is too light to always come right in the center of the punch, as it descends. Even if by some chance these light metal edges met exactly right, so that they butted well, there is not stock enough in the metal to hold well up to the work under the strain, and it would collapse in a heap. But they would not butt; experience has shown me that these edges would always slip past each other and spoil the job. Now, this is just where the mandrel comes in, and makes a good job out of what otherwise would have been a failure. Anyone, even one who has had no experience in this line, can see this by studying Fig. 3 in the article referred to. If, on the other hand, a tubular-shaped article had to be made ¼ inch outside diameter and 16 gage, it could not be made either with or without a mandrel without adding another operation. Mr. Wilder starts out to speak about the limitations of these methods and ends by practically saying there are no limitations, and that anything of tubular shape could be made without a mandrel.

Mr. Wilder claims to be the patentee of the method described in my Fig. 3, and says: "I can speak with authority in regard to the process and its limitations." I deny his right to any patent. The device is as old as the everlasting hills, and is well known, as he remarks, but only to people in this line of work. It is not *widely* known, and it certainly never was published before, nor were the other methods described where a mandrel is used. I have known this method or process over twenty-two years, and the men who taught me the trick knew it just as long before that; yet they never claimed to be the inventors, so they must have learned from others earlier still.

The comparison of a machine to a simple die is not relevant. It is more than probable that other results would be got from a machine, built at great expense for a special purpose, than from a simple die; but there can be no doubt that the metal would be put through more operations or there would be no reason for the machine's existence.

I made one error in my wording. I should have said: "There is still another way of forming tubes that are parallel, *or with only a small degree of taper.*" Tubes of great taper could not be made in this way; but at what taper it would be wise not to attempt it, I cannot say, so I thought it wise to make it read as I did.

In speaking-tube factories the tubes are made without a mandrel by a machine having a series of rollers in a line and quite close to each other, through which the blank passes, coming out a finished tube. The first rollers curl the metal nearly into a U-shape; the next rollers, which are quite close to them, curl it around a little more, and so on, until the last brings out a tube good enough for the purpose, but not by any means a perfect circle. I have seen tubes of much smaller diameter made this way, but, on the whole, not very successfully; so it appears that this process, too, has its limits, and the tubes must not be short pieces.

Some large pencil factories make penholders of the common kind by the million; these are made in the way I have described with a mandrel, but they add still another mandrel in a sizing or finishing die to insure good work. This kind of work has been done for fifty or sixty years; plenty of time to experiment in,

and can it be believed that if, as Mr. Wilder asserts, this light work can be done by his machine without a mandrel, and such a perfect job as to be air and water tight, that these rich companies would not long since have adopted it?

There are several other methods of forming tubes; one in particular, where the first operation is dispensed with and the whole of the curl is done in one operation. There are others that are too special to be worth mentioning here, but I think enough has been said about the subject. When a mechanic knows the three first principles which I described it is easy for him to devise the means for any special job that may turn up.

B. J. DOUGHERTY.

Keeping Track of Time and Material in Jobbing Shop.

Editor American Machinist:

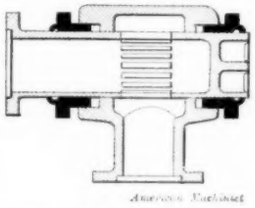
I enclose a job record in use in our shop, filled out to show the application and how easy it is to keep track of time and material on work in a jobbing shop. These tickets are partially filled by the foreman and turned in to the office for costs and charges to be added. There are lines for ten workmen for seven days. If more space is required another record is pinned to the first one. Or if five or fewer workmen work more than seven days on a job, the names are written again below. This may interest some of your readers.

J. L. GARD.

A Special Expansion Joint.

Editor American Machinist:

Herewith I send you a sketch of an expansion joint copied from the German Patent Letter No. 57,756, filed December 28, 1890, which you will see is identical with the joint published in the "American



A GERMAN EXPANSION JOINT.

Machinist" No. 33, page 930. I may mention that the said construction has been manufactured for some time past by A. E. G. Dehne at Halle a. S. There is no new thing under the sun! PAUL MÖLLER.

Berlin, Germany.

Cutting Square Threaded Screws.

Editor American Machinist:

I was very much interested in Mr. De Leeuw's article, on page 1160, about square threads. It seems to me he is in error about the shape of thread the tool usually used will cut. If you will refer to his illustration, Fig. 1, he shows the screw with the thread under-cut on the left-hand side and concave on the right-hand side. If the tool *I K L M* will cut a thread with the left-hand side undercut (and I have no doubt it will), I see no reason why it should not do the same on the other side as well, as the edge *M* overlaps the line showing the bottom of the thread on the right-hand side just as much as it does on the left-hand side. It would then make a thread the spaces of which would be wider at the bottom than at the top, providing the tool is set on the center as in the drawing. If the tool be set with the front cutting edge horizontal and at the hight of the edge *I*—that is, below the center—it would make a thread as shown by Mr. De Leeuw, as can be seen when you follow the line of the bottom of the thread, which disappears below the outside line and is shown to the left in the drawing, where, at *G*, it is carried down. It is this part of the screw which would remain and make the thread concave as shown, but as the tool is shown it is impossible for it to do it.

The above applies also to the threads of nuts, which should have a loose fit if the tools were set correctly and the threads cut deep enough to get over the round or hollowed-out bottom.

I would like to see this more fully discussed, as it seems perfectly plain to me; but I am open to conviction if I am wrong. I have had some experience like Mr. De Leeuw's man, but have usually found the difficulty to be that the threads were too thick. J. F. B.

A High Speed and Two Tapping Attachments for Drillers.

Editor American Machinist:

Having received much benefit and many good pointers from the "American Machinist," I would like to offer you a few sketches which may possibly be of interest to some of your readers.

It often happens that oil holes or other small holes have to be drilled in large castings which cannot be placed under a small drill press running at high speed and therefore have to be drilled on a large machine where you cannot get the right speed for the small drill. Fig. 1 shows a high-speed attachment applied to the upper cone of an upright drill press, but it can be used to the same advantage on other drilling machines. It can easily be put on an old machine, as it does not require any extra space or brackets. The attachment consists of what is commonly called a jack-in-the-box. *A* is the driven cone; when it is turned, bevel gears *B B*, which are loose on studs *C C*, revolve with it around bevel gears *D* and *E*. Gear *D* runs free in cone *A* and on shaft *N*, and gear *E* in cone flange *F*; gear *D* is splined to the double clutch *G*. This clutch is shifted by means of pull pin *H* and fork *I*. To gear *E* is keyed the back-gear pinion *L*; when the back gears (not shown in the sketch) are

JOB RECORD. BLANK & CO.

NAME OF JOB *Boring Turning Keyseating 6 - 36 x 2¼ Pulleys*

FOR *Eclipse Woolen Co.* Their Order No. *2950*

Order No. *930*
Ordered by *Evans*
Order Rec'd by *Simmons*
Ordered *Nov. 13* 1901
Begun *Nov. 26* 1901
Completed *" 29* 1901
Estimate

DAY OF WEEK	Tues.	Wed.	Thur.	Fri.			Total Cost of Labor $16.32½		Total Labor Charge $35.55	
DAY OF MONTH	26	27	28	29			Total Hours	Cost Pr. Hr.	Total Cost	Chg'd Pr. Hr.	Total Charge
NAME OF WORKMAN	HOURS WORKED.										
Anderson	4	9	9	7			29	32½	9.42½	75	21.70
Evans		6	9	8			23	30	6.90	60	13.80

MATERIAL	COST	AMOUNT CHARGED
None *Work done on 45" boring mill and keyseater.*		*American Machinist*

TIME AND MATERIAL TICKET FOR A JOBBING SHOP.

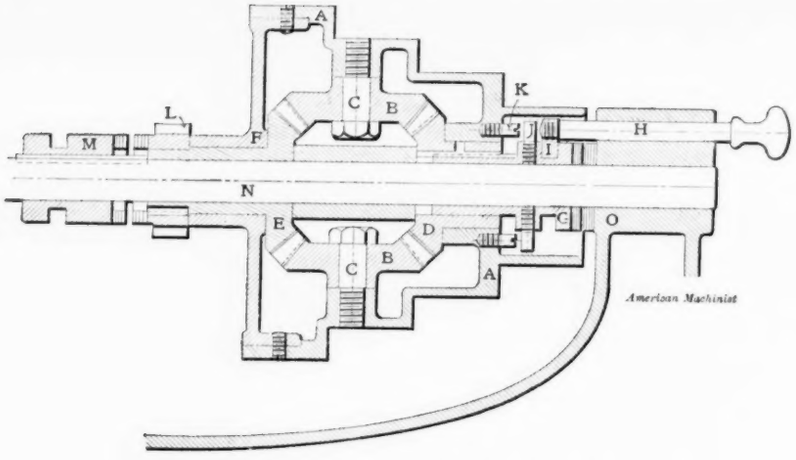


FIG. 1. HIGH-SPEED ATTACHMENT FOR DRILL PRESS.

not used the clutch *M* is engaged with the pinion *L* and turns the shaft *N*. For drilling regular work the clutch *G* is pushed in so that pins *J* come in contact with pins *K*, then all the gears are locked to the cone and turn with it. To obtain high speed, move the clutch *G* to the right and it becomes locked to the machine frame *O*. When the cone *A* is turned, the gears *B B* revolve around stationary gear *D* and in each revolution around *D* make one turn on their own axes. This causes gear *E* to make two rotations while cone *A* makes one.

Fig. 2 represents a tapping attachment for the drill press. *A* is the driven cone fastened to the bevel gear *B*, which runs free on the shaft *C*; the inner side of the gear *B* forms a clutch. A hole is drilled in the machine frame *D* to receive the

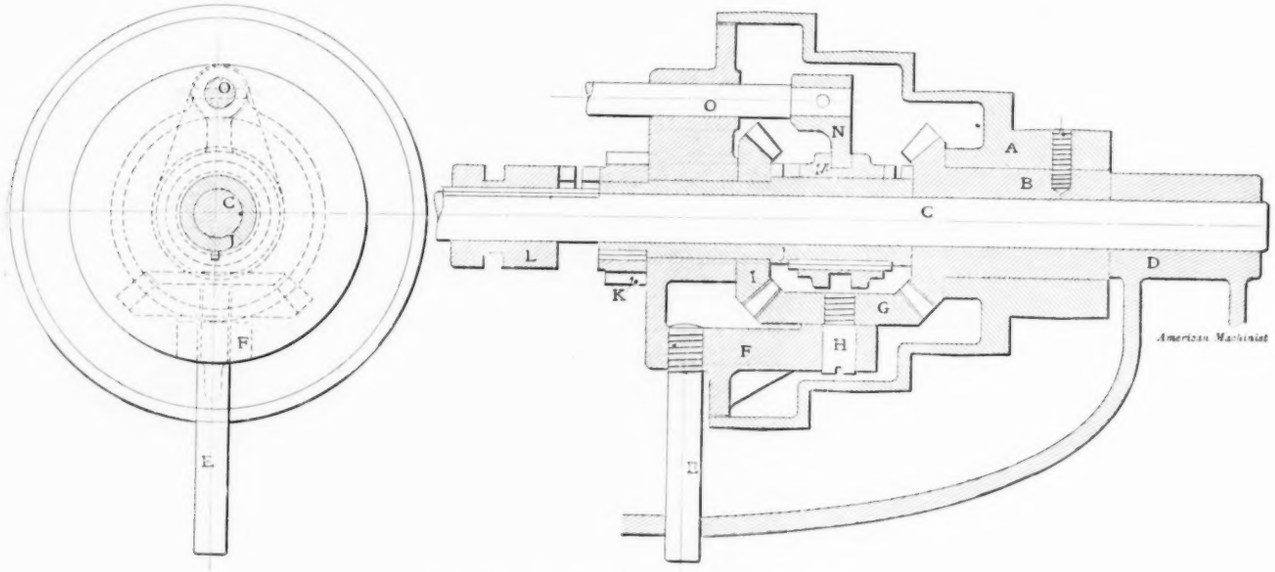


FIG. 2. TAPPING ATTACHMENT FOR DRILL PRESS.

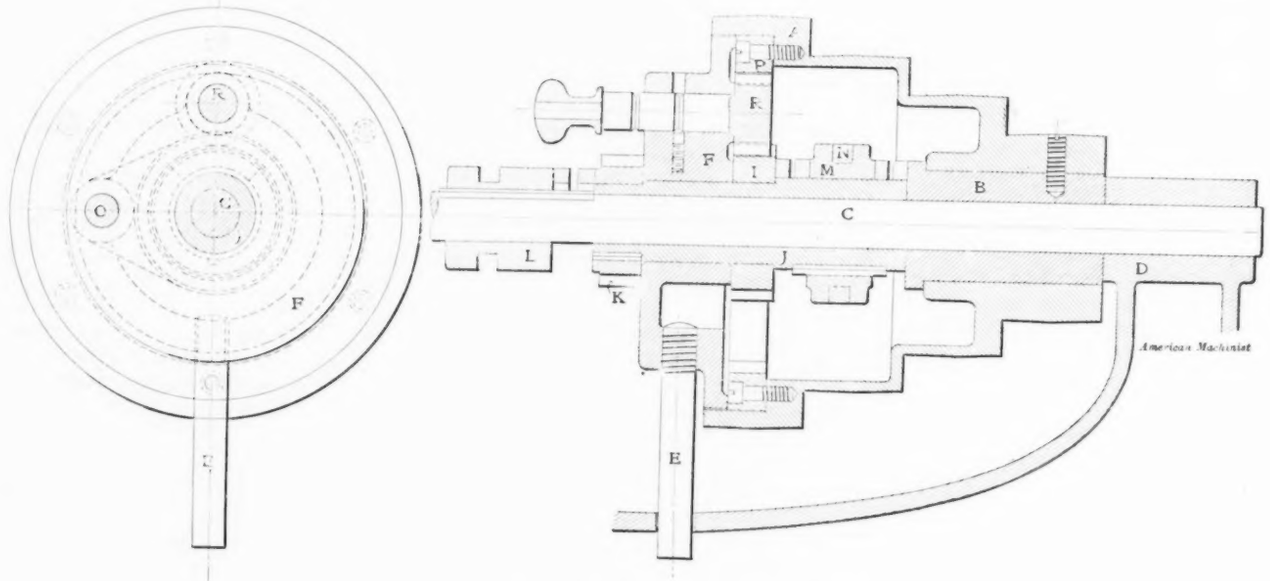


FIG. 3. TAPPING ATTACHMENT WITH QUICK RETURN.

stud *E*, which is screwed in the flange *F* to prevent it from turning. On the inner side of the flange *f* is an arm which carries the gear *G;* stud *H* is fastened into this gear and runs free in the arm. The clutch gear *I* runs loose on the sleeve *J* and in the opposite direction from gear *B*. To the outer end of the sleeve *J* is keyed the back-gear pinion *K*, and in case back gears are not used clutch *L* is connected with *K* to drive the shaft *C*. To the inner end of the sleeve *J* is splined the sliding clutch *M;* this is shifted through the fork *N* and the shifter rod *O*, which may be extended to the front of the machine and connected to a vertical lever, thus making a convenient shifting arrangement. For drilling and driving the tap in shift clutch *M* in engagement with gear *B* and for backing out engage it with gear *I*.

Fig. 3 is a similar device also used for tapping. The internal gear *P* is screwed to the cone *A* and is the driver for the shifting pinion *R*, which transmits motion to the clutch gear *I*. *R* runs in the same direction as *A* and *I* the opposite way. While *P* makes one rotation one way, *I* makes two rotations the other way if *I* is half the diameter of *P*, thus giving a fast backing-out speed. If the machine is not used for tapping, gear *R* can be shifted out of mesh with gear *P*, so preventing wear. Clutch *M* is shifted by means of the fork *N* and rod *O*, the same as described under Fig. 2.

HERMAN ISLER.

Hamilton, Ohio.

Cost Keeping in a Small Shop.

Editor American Machinist:

The system of time- and cost-keeping here described has been in use in the shop where it originated for about one year and has given very good satisfaction. I do not claim it to be superior or equal to the excellent and accurate methods from time to time described in your columns, except that it seems to be well adapted to the smaller establishments whose "overhead" expense per man employed is already comparatively high and where there is consequently little inclination to establish an elaborate and expensive time- and cost-keeping system.

Beginning with the foundation, the time-card, Fig. 1, each man is supplied with one each week. The different classes of work are divided as simply as possible. There being two specialties manufactured in this case, there is a column provided for each, so that at the end of each week the footings of these columns show the amount of labor to be charged to each. To "shop work" is charged all time that does not go directly to the production of the machines built, such as helper's time, sweeping, running errands, oiling and repairs.

In the "Special work" column is charged all time put in on new patterns, special tools, etc., and to each such pattern and tool is given a letter and number, so that, as shown in the illustration, no more writing need be done than the date and name of the workman; the balance of the work of marking down of time being merely a filling in of numbers, so that there is no danger of a tool or job being designated by four or five different names on as many time sheets, and little tendency to error exists. To further facilitate handling and filling in these cards without excessive soiling, each one is held on a board under a spring clip, and a leadpencil with eraser is attached thereto by a cord.

These cards for a week being collected, the time in each column is added and entered under its proper heading, the time on special work being also charged to each tool. When possible each tool is stamped with the letter and number by which it was known when being made, and for each month a report is made out containing all new tools, patterns, etc., finished during that month. These reports are used when taking the annual inventory, and as the description, cost and mark of every tool are therein given, they are of assistance in locating and identifying these tools.

Now, the time cards give only the labor on the special tools charged to each item, the "non-productive" labor and the total labor on each specialty manufactured, so that other means are necessary to obtain the cost of each machine part or operation. For this the shop order, Fig. 2, is used. One is handed out with every job or operation of which it is desired to ascertain the cost. The time of starting is filled in when the order is handed out and serves as a check on the time charged to the work when returned to the desk. These orders are dated when turned in, put on a spindle and afterwards entered in the cost book and destroyed, so that the men need not take especial care to keep them clean.

In the "Cost Book" a page is used for each piece; the operations are numbered as shown, the pattern number (if a casting) and weight are given, so that the "flat" cost of the piece can be found by adding the cost of labor to that of the material. When a piece is altered, a new tool is made to cheapen part of the work, or the piece is superseded by another; it is recorded in the wide margin to the right, so that it is possible to closely watch the effect of alterations and improvements on the cost of the piece.

On a sample page of the cost book herewith shown, the cost of operations is carried to 1-100 cent. It might be preferred to save time by figuring no closer than ¼ or even ½ cent, especially on more costly operations or on larger work, but these are details to be decided upon by taste or circumstances. On small work in larger quantities the cost might be carried out per 100 pieces to advantage.

CORNEIL RIDDERHOF.

TIME CARD.

(FILL OUT EACH DAY BEFORE LEAVING.)

WEEK COMMENCING *Sept. 7* 1901

NAME *J. Sailor*

	SPECIAL WORK Description	Time	Shop Work	Grinders	Friction Clutches	Total Each Day
MON.			2			
	T 212	1¼				*
				6½		10
TUES.						
WED.						
THUR.						
FRI.						
SAT.						

American Machinist

FIG. 1.

SHOP ORDER

MR. *P. Dole*

PLEASE *Grind hangerboxes*

JOB STARTED AT *9.15 Sat.*

NO. OF PIECES *52*

TIME *1* HRS.

FILL OUT AND RETURN TO DESK WHEN JOB IS FINISHED.

American Machinist

FIG. 2.

Hanger box. F C₂

	Date	No	Op.	Workman	Mach.	Remarks	Time	at	Cost		Each		2½ # C I 7.5	
	2/27 01	24	2.3	J. Rogers	5		11	12½	137	5	5	73		
	2/28	24	4	J. Sailor			1½	10	15			63		
	3/4	24	5	C. Loom			1	16	16			67	Grind	1
	4/13	52	1	P. Dole	17		1	13	13			25	Bore	2
													Face ends	3
													Clean oilgroove and fit to hanger	4
													Paint	5

American Machinist

FIG. 3. A PAGE OF THE COST BOOK.

A Chart for Plain Bearings.

Editor American Machinist:

Some time ago I saw in your columns a request for a rule by which to calculate the required thickness of babbitt for shaft boxes. A rule I have followed for some years is:

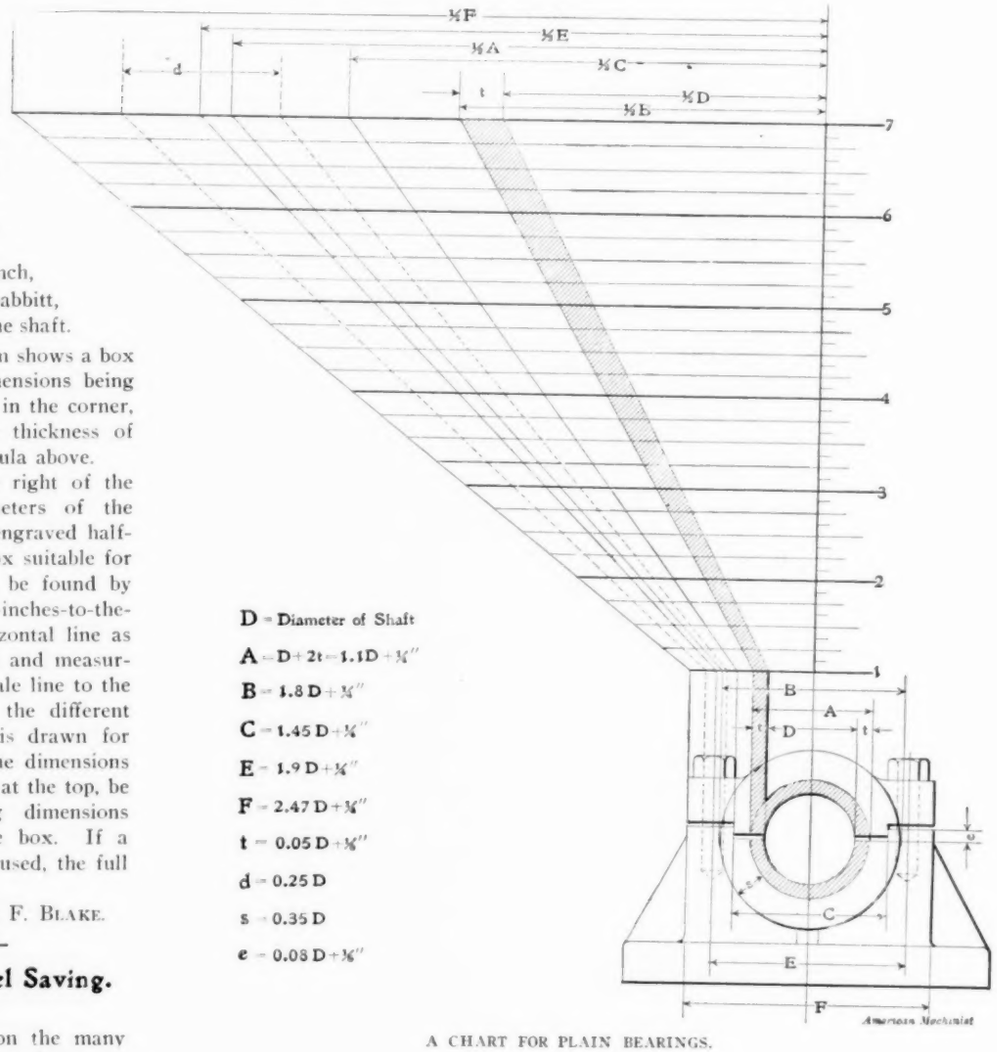
$$t = 0.05\,D + \tfrac{1}{8} \text{ inch},$$

where t = the thickness of babbitt,
D = the diameter of the shaft.

The accompanying diagram shows a box for a 1-inch shaft, the dimensions being those given by the formulas in the corner, which are based upon the thickness of babbitt required by the formula above.

The vertical scale at the right of the chart represents the diameters of the shafts, and as the chart is engraved half-size, the dimensions for a box suitable for any diameter of shaft may be found by measurement by laying a 6-inches-to-the-foot scale on the same horizontal line as the shaft diameter is found, and measuring the distance from the scale line to the diagonal lines representing the different dimensions. As the chart is drawn for only one side of the box, the dimensions thus obtained will, as shown at the top, be half of the corresponding dimensions given on the figure of the box. If a 3-inches-to-the-foot scale be used, the full dimensions will be found.

C. F. BLAKE.



A CHART FOR PLAIN BEARINGS.

A Record Case of Fuel Saving.

Editor American Machinist:

I have been reading up on the many economies that are possible at the steam end of the works (and works is better than shop) by the introduction of the several articles that are sold to that end for the buyer and another end for the seller. I do not wish to imply that economies may not be realized in the average steam plant, but rather that the proprietors, having their heads full of other business, really do not give this subject its due attention. With this preface I'll tell my story:

Some years ago I was sent to inspect a boiler for a planing mill and found an old 14′x48″ horizontal tubular boiler in a state of decrepitude that called for action or a loss. Bulges, patches, fire cracks, and cracks between tubes at back head; scale half inch thick, and other ear marks of an early dissolution were there. So on

Monday, at 7 A. M. sharp, I met the owner of the plant and explained matters; also speculated on the energy contained in the old tub and advised a new boiler within thirty days. After the usual preliminary argument I got him going my way. He was on acquaintance a fine man, and, liking him, I took quite an interest in the case. He accepted my advice, putting in a 16'x66" boiler of good material, design and workmanship. During its erection and by his request I called daily at the plant, looking after the details of erection and on one such visit I met the proprietor of a thriving livery stable in the same block, who wanted to know if he could not buy some shavings for bedding his horses. Acting for the owner of the plant, I closed a deal with the liveryman whereby for a certain sum per week he was to have all the shavings, taking them away at his own expense, but returning them also at his expense for fuel for the boiler. The old boiler had been crowded very hard, the shavings being all used and from 1,000 pounds to a ton of coal per day in addition. As the new boiler was of ample size for the load, I figured the livery-barn money was to be clean, good profit, and it proved true. On starting up the new boiler it was found that the stable refuse and mill waste furnished an ample supply of fuel, no coal being needed. As the proprietor had never tried or thought of selling his shavings, he had therefore looked upon his coal bill as his only fuel expense. As he now had no coal bill his saving over the old boiler was 100 per cent. In addition to this, his weekly receipts from the livery barn equaled one-fourth of his former coal bill, and therefore his total saving was 125 per cent. I believe this is the record on fuel saving. Of course, we could not have saved anything over the coal bill, but for the livery-barn deal, and, incidentally, it was a good thing for the liveryman, as it saved him money in hauling his bedding a much longer distance for disposal.

The moral of this true story is that there are several ways to earn profits outside of the sales department. DUPLEX.

The Reciprocity Convention.

So far as the earlier sessions of the Reciprocity convention at Washington were concerned, those who feared that the convention was to fall into the hands of the free traders and thus be made a propaganda for absolute and universal commercial liberty, and who staid away on that account, would have been agreeably surprised had they been present, for it is made clear that no matter what the individual manufacturer may say with regard to his own business and the need of tariff protection for it, an overwhelming majority of American manufacturers are firm believers in the principle of protection. The fact that the convention was not given over to the free traders is of course due to the fact that there were plenty of manufacturers who believe in protection but favor reciprocity, and who at the same time perceived the essential absurdity of remaining away from the convention instead of attending and assisting in the prevention of the capture they professed to fear.

As a matter of fact, there seemed very little chance for a capture of the convention or of stampeding it by anybody, for it was carried on by what are referred to in politics as "cut and dried" methods—*i. e.*, a previously arranged program was carried out strictly, and all the officers were elected and all rules adopted in strict accordance with the previously arranged program.

The temporary chairman, D. A. Tompkins, of Charlotte, N. C., was roundly applauded when he declared for "no abandonment of the policies by which the magnificent industrial results in our nation have been obtained"; and also when he declared for the fundamental necessity of preserving the home market.

Mr. Theodore C. Search, the permanent chairman, was even more emphatic. He announced himself, as he previously had done at Detroit, a life-long Protectionist, whose faith in the wisdom, justice and efficiency of that system remained unshaken. He remarked that those who had refused to come here to confer were estopped from criticism of what was done, and added: "They charge that we have organized to stimulate tariff revision, when our object is directly the opposite. Our aim is to forestall tariff revision."

Mr. Search, however, opposed the idea (which we have commented upon in our columns) that reciprocity can be made to amount to anything or do any good whatever if we attempt to confine it to those things which are not produced here. Mr. Search said this would practically give us only tea and coffee as articles with which to work in arranging reciprocity treaties, and one of these is now free, while the other is being raised in small quantities in South Carolina. He showed by quotations from Mr. Roosevelt at Minneapolis and Mr. McKinley at Buffalo that neither had hinted at any such notion of reciprocity as this. Mr. Search announced that the principles at the basis of the real reciprocity movement are:

First, that some duties in our present tariff are no longer necessary for the industries which they were intended to protect.

Second, that the home market can no longer absorb the entire product of many industries, and

Third, that the establishment of more cordial commercial relations with other nations is necessary to the successive enlargement of our outlet.

In his address on taking the chair as permanent chairman Mr. Search further emphasized these points, and said:

"Our aim has been to forestall tariff agitation, not to encourage it. It is the duty of this convention to harmonize, as far as possible, the widely differing opinions represented in this body, and to reduce to clear and forceful expression such principles as we hold in common. We are here to harmonize our views, not to emphasize our differences. This is no time or place for sentiment, for theories, or for statements that cannot be fully substantiated by facts. I take it we are all agreed as to certain general propositions such as these:

"That some of the duties embraced in our present tariff are no longer needful for the existence of the industries for whose protection they are imposed.

"That many of our industries have reached a stage in their development where the home market alone cannot absorb their entire product, and consequently new outlets are necessary for their continuous operation and the steady employment of their operatives.

"That the establishment of more cordial commercial relations with other nations by means of an exchange of tariff concessions would enlarge the foreign outlets of those industries for which increased export trade is necessary.

"That, if such applications of the principles of commercial reciprocity could be made without injury to any of our industries the consequent expansion of our foreign trade would be beneficial to all our commercial and industrial interests.

"Coffee and tea are about the only great staple articles of commerce which we do not produce, and if reciprocity be limited to the use of these two commodities as a basis for negotiations we cannot expect to make much progress. To insist upon strict adherence to such a principle in making application of reciprocity is virtually to oppose its use in any practical form. The reciprocity that is wanted to-day is a reciprocity that means something and promises something in the shape of tangible advantages for our commerce, not merely expressions of kind sentiment toward all the business world, but an actual giving and taking of concessions that will open wider for us the markets of the world and broaden the distribution of our products."

The general discussion was opened by A. B. Farquar, of York, Pa., who sustained the views of the temporary and the permanent chairmen and said that reciprocity was a necessity, and that the interests of a few unimportant industries must not be allowed to stand in the way of it.

Then came Charles Heber Clark, of Philadelphia, the same who interjected a howl for free coinage of silver into the first convention of the National Association of Manufacturers in Cincinnati in January, 1895, and who for some years afterward ran the organ of the Manufacturers' Club of Philadelphia as a silver organ. He spoke for protection, pure and simple as well as unlimited. He evidently believed in regular old-fashioned Chinese-wall protection without reciprocity or abate-

ments of any kind, and so far as could be judged from the behavior of the convention during his speech, he had his hearers with him.

A number of other speakers followed with short addresses, and they differed, some being for reciprocity with a big "R," and others only mildly in favor of it or opposed, and among these a delegate—G. A. Loughlin, of Wheeling, W. Va.—attacked the United States Steel Company, and said that before its organization his company had been able to buy its materials at a figure that enabled it to sell in all the markets of the world, but since the organization of the United States Steel Company this trade had been seriously interfered with, and the present outlook was that his company's trade with South America would be extinguished shortly.

The session of Tuesday evening was devoted to South American trade, and naturally the recently imposed duty on hides came up, the prevalent opinion being that it benefited nobody except the large packers, and ought to be repealed or traded for reciprocal concessions.

W. B. Rice, of Boston, while speaking on this subject, was called to order by the chair and requested to confine himself to reciprocity and not to drift upon the tariff question, to which Mr. Rice retorted that he did not think anyone could talk reciprocity without talking tariff, a reply which brought out general laughter.

At Wednesday's sessions there was much more speaking, but it came to nothing, and finally the convention adjourned Wednesday evening, after adopting the following resolutions:

Whereas, The growth of manufactures in the United States, represented in values and in round numbers, has been as follows: 1850, $1,000,000,000; 1860, $2,000,000,000; 1870, $4,000,000,000; 1880, $5,500,000,000; 1890, $9,000,000,000; 1900, $15,000,000,000.

And whereas, These figures exhibit at the same time (1) a splendid result for the past industrial policies of our Government, and (2) a growing need for the development of larger markets in foreign countries.

And whereas, it would seem desirable, not only to maintain policies under which such splendid results have been accomplished, but also devise means to develop increased markets for the increased and increasing manufactured products,

Therefore, be it resolved:

(1) That this convention recommends to Congress the maintenance of the principle of protection for the home market, and to open up by reciprocity opportunities for increased foreign trade by special modifications of the tariff in special cases only where it can be done without injury to any of our home interests of manufacturing, commerce, or farming.

(2) That in order to ascertain the influence of any proposed treaty on our home interests, this convention recommends to Congress the establishment of a reciprocity commission, which shall be charged with the duty of investigating the condition of any industry, and reporting the same to the Executive and to Congress, for guidance in negotiating reciprocal trade agreements.

Whereas, The present and increasing magnitude of the aggregate manufacturing and commercial interests of the United States has become far too great to be adequately handled by any of the existing government departments; and

Whereas, Changing phases of these great interests are constantly bringing new and important questions, the proper determination of which would require all the work of a department fully organized and equipped,

Therefore, be it resolved:

(1) This convention recommends to and requests of Congress that a new department be created, to be called the "Department of Commerce and Industries," the head of which shall be a member of the President's Cabinet.

(2) That a reciprocity commission be created as a bureau of this department.

This is generally looked upon as a very lame and impotent result of the much-vaunted reciprocity convention. Of course if industries could be found wherein all the manufacturers engaged would agree that, say, half or perhaps all of the duty might be taken off without danger of injury to their particular industry, then in strict accordance with the resolutions that particular duty might be used in a reciprocity treaty. But the trouble would be to secure such unanimity.

It was clearly seen toward the end of the sessions that some of the rules (that had been not only formulated but printed before the convention met) were calculated to prevent anything like a full and fair discussion of the subject the convention was called to discuss. Though it is probable that President Search had endorsed these rules, it does not seem probable that he expected them to work in just the way they did, because the net result was to stifle free discussion and to absolutely prevent important resolutions from coming before the convention. The particular rule that did this was Rule 5, which reads as follows:

"All resolutions to be submitted to the convention shall be presented in duplicate, signed by the proponent and handed to the secretary, to be by him referred to the Committee on Resolutions without reading or debate."

This, it will be seen, placed it within the power of the Committee on Resolutions to decide what resolutions should be offered or discussed and the Committee was not at all backward in exercising its prerogatives. A paragraph of the program reads as follows:

"The Committee on Resolutions will report during the various sessions such resolutions as may relate to the subjects under discussion. It is quite necessary, therefore, that all resolutions shall be handed to the secretary for reference to the Committee on Resolutions as early as possible during the convention."

It was generally thought that this meant that the Committee would during the progress of the sessions present for discussion such resolutions as might be offered that pertained to the subject of reciprocity. But the Committee did nothing of the kind. There is a long list of resolutions presented to the Committee which resolutions never again saw the light. Among these is one by W. L. Saunders, of the Ingersoll-Sergeant Drill Company, who has made a special study of reciprocity and who, as he has a large foreign trade in machinery, ought to be entitled to be heard in a convention called to discuss these very matters. His resolution reads as follows:

"Resolved, That such of our tariffs as are now no longer needed for revenue or to encourage and protect our industries at home should be employed through reciprocity treaties to extend and promote our markets abroad."

This would seem to be innocent enough for anyone who had any use whatever for reciprocity, but it was too strong for the Committee on Resolutions. It is fair to say also that a number of resolutions on the other side, *i. e.*, directly opposed to reciprocity, were also pigeon-holed, but the place of these was taken by the resolutions actually presented and adopted, as printed above.

Annual Meeting of the American Society of Mechanical Engineers.

The full program of the coming meeting of the American Society of Mechanical Engineers is announced. The first session will be at the Society House on Tuesday evening, when a paper on "The Early History of Open Hearth Steel Manufacture in the United States" will be read by the retiring president, Mr. Samuel T. Wellman.

On Wednesday morning the annual business session will be held. Besides the election of officers and of new members the proposed amendment to the rules increasing the annual dues will come up for discussion and action. Topical discussions will follow.

The usual reception will be held at Sherry's on Wednesday evening. An innovation will be the use of tickets of admission for all who attend.

The reading and discussion of papers will occupy the Thursday morning session.

Thursday afternoon will be taken up by elaborate ceremonies in connection with the dedication of the monument to Robert Fulton in Trinity Churchyard. Addresses will be delivered by Rear Admiral Melville, Chief Engineer B. F. Isherwood and Dr. R. H. Thurston. Services of a religious character will also be held in Trinity

Church, conducted by Rev. Dr. Dix, with an address by Rev. R. F. Crary, a grandson of Robert Fulton.

Professional papers will be read on Thursday evening and also at the concluding session on Friday morning. The following is the list of papers and topical discussions and the order in which they are to be presented:

Wednesday morning: Topical Discussions—Cost of Running Trains at High Speed; Some Peculiarities of Springs; The Linvolpon System of Units.

Thursday morning: Professional Papers—F. B. Corey, "A Portable Accelerometer for Railway Testing"; H. L. Gantt, "A Bonus System of Rewarding Labor"; J. O. Nixon, "A Silent Chain Gear"; C. H. Benjamin, "The Bursting of Small Cast-Iron Flywheels."

Thursday evening: Preliminary Report of the Committee appointed to codify and standardize the methods of making engine tests; report of the Committee on Standardization of Engines and Dynamos; E. W. Naylor, "A New Valve Gear for Gas, Steam and Air Engines"; F. A. Scheffler, "The Potter Mesh Separator."

Friday morning: C. W. Hunt, "Working Loads for Manila Ropes"; H. C. Lucke, "The Heat Engine Problem"; C. H. Benjamin and R. A. French, "Experiments on Spiral Springs"; W. C. Johnson, "Water Power Development at Hannawa Falls"; W. R. Warner, "The Porro Prism"; Albert Kingsbury, "Effect of Clearance on the Economy of a Small Engine."

Examination for Draftsmen.

The United States Civil Service Commission, Washington, D. C., announces that examinations will be held at various places throughout the country, December 30-31, 1901, for heating and ventilating draftsman, Treasury Department, at $1,200 a year, and January 2, 3 and 4, 1902, for five mechanical draftsmen, Ordnance Department, at $1,200 a year. Further particulars, application blanks, etc., may be had from the Commission.

Something Worth While.

"Did you read that magazine poem which begs the fates to 'give us yesterday'?" asked the long-haired person. "It was sublime."

"No," answered the short-haired man. "But if any of those fellows write anything about 'give us payday,' I'll take a look at it."—Baltimore American.

There is talk at the present time of moving the Baldwin Locomotive Works either to a suburb of Philadelphia or to some other point. The continual growth of the works makes necessary the closing of two important streets, to which the city council will not consent. Mr. Converse, representing the works, said that they now employ 10,500 men, of whom 10,000 are American citizens and 9,000 are voters. The founding of a works in a new location would involve the building of a city of at least 100,000 persons to begin with. In the natural course of events a change of location for such an establishment would seem to be inevitable. Unlimited growth in the present location must be impossible, and the accumulating restrictions must be prohibitive of some important modern facilities and economies.

A big passenger locomotive, which the Baltimore & Ohio Railway Company recently donated to the West Virginia University, has been put in the new Engineering Building. The instructors and students in the engineering department moved it through the streets of Morgantown, propelling it with its own steam over a temporary track. There are about 115 students in the College of Engineering at the university this year. The demand in West Virginia for civil, mechanical, mining and electrical engineers is growing so rapidly that the supply does not equal the demand.

In consequence of reported cases of firemen receiving shocks while directing water jets on to live electric conductors, M. G. Semenza has carried out some instructive experiments to determine the minimum length of jet through which a shock is sensible at different voltages. For a jet 12 mm. in diameter, a curve is given between pressure and length of jet; at the maximum voltage employed of 3,600 volts, sensation was perceptible through a length of jet of 3½ meters; the shock was, however, quite endurable at a length of 1 meter. From these experiments the author concludes it to be impossible for a fireman in ordinary work to receive shocks from any conductor without actually touching the wire with the nozzle.—"The Engineer."

A mechanic of our acquaintance, a native of Switzerland, but who worked in this country for some years and is now connected with an electrical works in that country, writes us that electricity and electrical machinery are on the boom in Switzerland now, and seem likely to continue so for some time, as the "Switzers" perceive that it is most decidedly to their advantage to employ the constant-running, mountain streams supplied by eternal ice and snow, rather than to pay for imported coal, by which power must be otherwise developed. It seems likely that eventually most of the water-power capacity of the country will be fully utilized, now that it is practicable to convey power thus generated over wires to places where it can be conveniently or advantageously used.

Through the co-operation of the New York Central & Hudson River Railway, Purdue University, La Fayette, Ind., has secured an exhibit of primitive railway track which was exposed in the course of excavations on the line of the old Mohawk & Hudson Railroad. Notwithstanding the fact that the track had been so long covered that everybody connected with the road appears to have forgotten its existence, it was found to be in a fair state of preservation. The exhibit consists of stone sleepers, stringers and rails, and altogether weighs 2,700 pounds. The university has also an exhibit of the so-called "bull-rail" track, representing a somewhat later date, taken from the Central Railway of Georgia.

Our esteemed British contemporary, "The Electrical Review," is entirely mistaken when it says that we are "very angry" at its remarks about us. We had not the least thought of being angry. We are only mildly amused at what "The Electrical Review" has had to say about international trade.

The Industrial Committee of the Cleveland Chamber of Commerce has addressed a circular to those who are interested in industrial matters and especially the members of the Chamber of Commerce, regarding what has come to be called "industrial betterment," and enclosing therewith an editorial from the "Iron Trade Review," of Cleveland, undertaking to show that, notwithstanding the occurrences at Dayton, conciliation in industrial matters cannot be considered a failure. We have no doubt that the secretary of the Cleveland Chamber of Commerce, Mr. W. H. Moulton, will be glad to send this matter to anyone interested in it.

Col. Allan C. Bakewell, of 479 Fifth avenue, New York city, has been appointed to represent the electrical interests of New York State to receive subscriptions for the McKinley National Memorial Association, which is raising funds for the erection and maintenance at Canton, Ohio, of a suitable memorial to the late President McKinley. Mr. Bakewell asks us to announce that no money should be paid to anyone purporting to represent him, unless provided with satisfactory credentials.

"Gauge" or "Gage"?

There was once an editor "sauge"
Who sought to improve the "launguauge,"
With his pencil "blueugh"
He ran the "yough" through,
And nothing was left but "gage."
—"Junius," in "The Wood Worker."

Obituary.

Capt. John Lawson died at St. Louis, Mo., a few days ago, ninety-six years old. He was born in Manchester, England, and as an apprentice under George Stephenson he worked on the first locomotive. He came to this country and ran engines on different railroads for a number of years. He later went into steamboating on the Mississippi and acquired a fortune years ago.

New Catalogs.

The Pneumatic Engineering Company, of 128 Broadway, New York, sends us a trade publication in relation to its Halsey pneumatic pump, which may be briefly described as an air pulsometer.

"Electric Heating" is a catalog sent us by the Simplex Electrical Company, Cambridgeport, Mass. It shows heating devices for numerous purposes, among which are soldering irons, solder pots and glue pots. Size of page, 5x8 inches.

McCrosky & Huber, Cincinnati, O., have published a little catalog of universal adjustable reamers and combination tool-holders. The reamers are hand, shell, etc., and are listed in many sizes, with prices. The pamphlet is 3½x6¼ inches.

E. W. Bliss Company, Brooklyn, N. Y., has brought out a special catalog of drawing presses and spinning lathes. Both lines are quite extensively dealt with. A number of reducing and cam-drawing are included. The pamphlet is 5x7 inches.

We have received a supplementary catalog, "S," of the Boston Gear Works, Purchase and Pearl streets, Boston, Mass. The subjects considered are bevel and spur compensating gears, chains, sprockets, raw-hide and fiber gears, tool-steel balls, worm hobs, steel pinion wire, cutters, etc. Size, standard, 6x9 inches.

"The Building of a Modern Locomotive," by Paul T. Warner, constitutes "Record of Recent Construction, No. 29," of the Baldwin Locomotive Works, Philadelphia. It is an extensive illustrated account of the shop processes of locomotive building and is reprinted from the "Brotherhood of Locomotive Firemen's Magazine," February, 1901. Size, standard, 9x6 inches.

Chas. H. Besly & Co., 10 Canal street, Chicago, Ill., have sent us a 1902 catalog. Among the lines presented are Gardner grinders, spirally grooved circular disks for use on same, Helmet cement, Besly band polishing wheels and machines, Helmet babbitt, bronze spring and wire, lathe dogs, parallel clamps, Helmet oil, oil cups, stocks, dies, taps, etc. Size, 5½x9 inches.

The Long & Allstatter Company, Hamilton, O., has brought out catalog No. 20, devoted to its punching and shearing machinery. This contains 160 pages showing a great variety of machines for these purposes and also a few others, such as horizontal bending or forming machines, tire welding machines, drop and helve hammers, bending rolls and a side grinding machine. Size of pamphlet, 6½x9 inches.

W. C. Toles & Co., manufacturers of rapid-acting vises and special machinery, Irving Park, Chicago, Ill., have sent us a catalog showing a line of rapid-acting vises for woodworkers and iron workers. The former kind are set forth in a number of varieties—with bench stop, side grip, front jaw dog, tail vise, combination vises, etc. A line of manual training benches is presented. Size of page, standard, 6x9 inches.

John Acton, 118 John street, Brooklyn, N. Y., has published a new catalog of the Acton automatic steam, water, air and vacuum specialties, etc. Among the devices shown are reducing, back pressure, relief, pop safety and other valves, governors, thermostats, filters and oil collectors, steam traps, etc.; pulverizing mills and glass polishing and roughing machinery. Size of page, 3½x6½ inches.

The Norton Emery Wheel Company, Worcester, Mass., has brought out a new catalog, the contents of which are briefly described as covering emery and corundum wheels, grinding machinery, emery bricks and slips and India oil stones. There is an especially copious illustrated and priced list of wheels of various shapes for different makes of grinding machinery. The catalog contains 164 pages, 6x9¼ inches.

The American Ferrofix Company, 20 Broad street, New York, has published a "shop book" (to hang up in the shop) describing the "Ferrofix" and "Borfix" processes for brazing cast iron and mentioning the use of "Borfix" for general brazing. We have several times this year referred to the Ferrofix discovery. The pamphlet is 4½x12 inches. The company states that heavy paper books for use at the forge are furnished on request.

We have received a little catalog, No. 12, of the Keystone Manufacturing Company, Buffalo, N. Y. Among the manufactures of the company, as here presented, are the following: "Keystone" reversible ratchet drills, "Monarch" single-acting ratchet drills; ratchet socket wrenches, tap wrenches and stud drivers; Westcott adjustable "S" wrenches for nuts and pipe, Morse taper sleeves and steel sockets, nail-sets, boring tool-holders, etc. The pamphlet is 3¼x6 inches.

New Corporations.

Alan Wood Iron & Steel Company, Philadelphia, Pa.; capital, $1,250,000.

Griffiths Charcoal Iron Mills, Clinton Township, Washington County, Pa.; capital, $200,000.

Crossman Edge Tool Company, Warren, Mass.; Casper Ranger, president; I. T. F. MacDonnell, treasurer; capital, $7,000.

R. & G. Typewriter Co., of New York city; capital, $50,000. Directors: W. R. Heath, C. S. Brown and C. J. Christensen, of New York city.

Manhattan Engineering Co., of New York city; capital, $5,000. Directors: B. A. Keiley, J. T. Keiley and H. M. Haviland, of New York city.

Lane Bridge Co., of Painted Post, Steuben County, N. Y.; capital, $50,000. Directors: D. F. Lane, A. E. Lane and C. W. Smith, of Painted Post.

South Jersey Mobile Transit Co.; capital, $100,000; object, manufacturing automobiles; incorporators: John B. Hummel, Edwin R. Laning, Eugene L. Laning.

Petro Car Company, of New York city; capital, $50,000. Directors: G. R. Burroughs, of New York city; O. C. Sand, of Brooklyn, and O. W. Jones, of Richmond Borough.

Printers' Roller Washing Machine Co., of New York city; capital, $15,000. Directors: H. A. Richardson and Samuel Crump, of Poughkeepsie, and H. H. Richardson, of New York city.

Stiles Safety Sand Box Company, Orange, N. J.; object, manufacturing sand boxes for railroads, etc.; capital, $25,000. Incorporators: John T. Hoag, Henry B. Culver and John Slade.

Standard Gasket Company, 419 Market street, Camden, N. J.; object, manufacturing metal gaskets; capital, $15,000. Incorporators: Wm. G. Phyall, Wm. M. Gordon, John A. MacPeak.

Automobile & Marine Power Co., 110 Erie street, Camden, N. J.; object, manufacturing automobiles, etc.; capital, $150,000. Incorporators: Albert L. Kull, Edw. M. Pine and Wm. C. French.

Courtney Bolster & Truck Co., 525 Main street, East Orange, N. J.; object, manufacturing railway supplies; capital, $15,000. Incorporators—Chas. P. Brooks, Luther B. Eaton, C. Fred Smith.

Standard Power Co., of New York city; object, manufacturing machinery for generating power for vehicles; capital, $200,000. Directors: A. F. Swan, T. S. Seelye and Thomas Howard, of New York city.

Eastern Sanitary Street Cleaning Co., 24 Washington street, Jersey City, N. J.; object, manufacturing street cleaning machines; capital, $1,000,000. Incorporators: Henry Shippy, Hiram D. Layman and others.

H. W. Johns Paint Manufacturing Company; principal office, 419 Market street, Camden, N. J.; object, manufacturing paint; capital, $150,000. Incorporators: H. W. Johns, G. W. Gladwin, F. R. Boocock.

New Century Car Heater Co.; principal office, 243 Washington street, Jersey City, N. J.; object, manufacturing car heaters; capital, $200,000. Incorporators: Herbert H. Shannon, Edward S. Carr and Henry C. Shannon.

Automatic Car Lock & Seal Co.; principal office, 419 Market street, Camden, N. J.; object, manufacturing car locks, seals, etc.; capital, $500,000. Incorporators: Joseph D. Donovan, Charles F. Thompson and David L. Harris.

Chandlee Wire Fence Co., 612 South Broad street, Trenton, N. J.; object, manufacturing wire fencing; capital, $300,000. Incorporators: J. Russell Kelso, Chas. T. Crane, J. Kemp Bartlett, Albert S. J. Owens and Alfred N. Barber.

Standard Manufacturing & Elevator Corporation; Corporation Trust Co., 15 Exchange place, Jersey City, N. J.; object, manufacturing elevators; capital, $125,000. Incorporators: Daniel A. Griffin, James D. Evans and Geo. D. Ayres.

National Mill Supply Co., Railroad avenue and Slater street, Paterson, N. J.; object, manufacturing textile machinery; capital, $10,000. Incorporators: Louis H. Rothschild, Joseph Rothschild, Edwin B. Hindley and Arthur W. Hindley.

National Automatic Tool Co.; principal office, Corporation Trust Co. Building, 15 Exchange place, Jersey City, N. J. Object, manufacturing tools; capital, $125,000. Incorporators: K. K. McLaren, C. W. Perkins and Aug. S. Meeker.

The Standard Fertilizer Manufacturing Co., with a capital of $1,000,000, has been organized at Birmingham, Ala. John C. Brain, Robert H. Yell, John L. Burnes and R. B. Jones, of Birmingham, and B. C. Jones and W. K. Smith, of Bessemer, are the incorporators. The company's purpose is to manufacture commercial fertilizer from the slag refuse of the furnaces of the district by a process recently invented.

The following are among increases of capital stock authorized in Pennsylvania during October: Carnegie Tube Company, Pittsburgh, from $150,000 to $300,000; Brown & Zortman Machinery Company, Pittsburgh, from $25,000 to $100,000; Keystone Car Wheel Company, Pittsburgh, from $200,000 to $400,000; Philadelphia Foundry & Machine Company, from $1,000 (?) to $75,000; National Cable & Wire Company, Pittsburgh, from $11,000 to $500,000.

Manufacturers.

The Clarksburg (W. Va.) Woolen Mill has been burned.

The East Rockford Mantel Company, Rockford, Ill., is building an addition.

The Haughton Elevator & Machine Company, Toledo, O., is in the market for machinery equipment.

The Sterling (Ill.) Gas & Electric Light Company is making arrangements for building a new gas-making plant.

The Pennsylvania Rubber Company, Erie, Pa., is desirous of securing a site in the Pittsburgh manufacturing district.